

Edited at the
Massachusetts Institute of Technology
February, 1969. Price, \$1

William C. Foster: The Arms Race—
Danger and Opportunity

Mason Haire: Industrial Technology
and Urban Affairs



Technology Review

Man-
Machine
Relations
in the
Apollo
System



technology review

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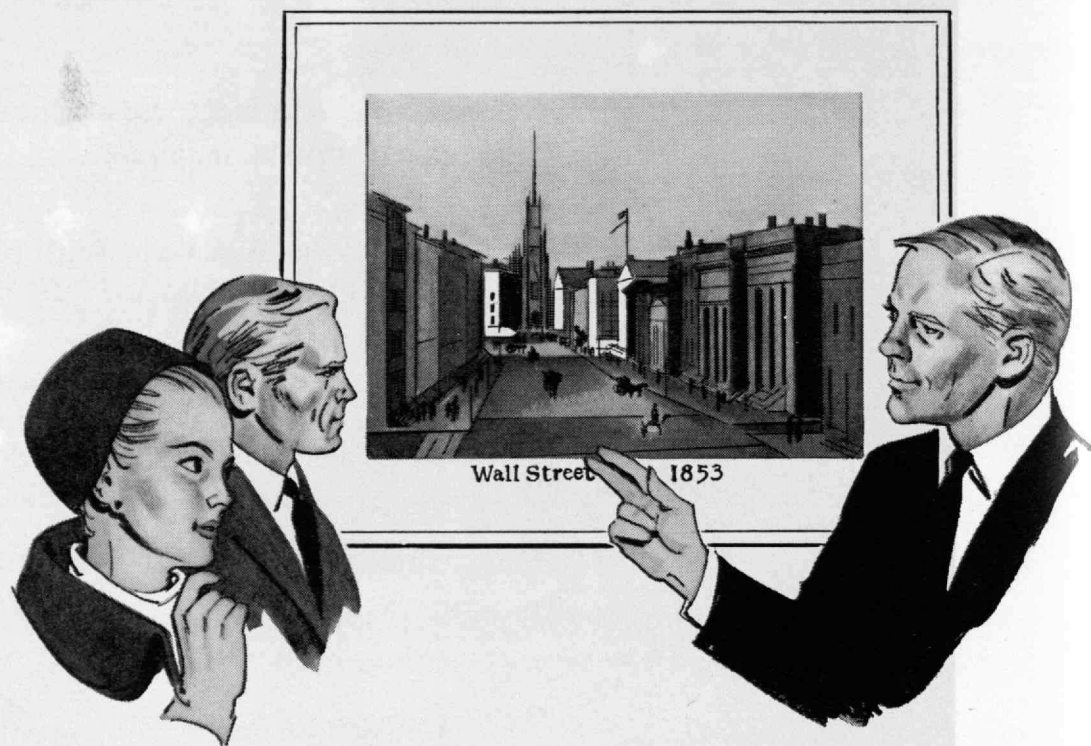
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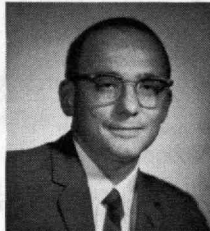
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Van Putte is the name—Douglas—and plastics* is the game. While other Kodak engineers find strong interest in parts of the plastics market where a one-cent change in price can turn failure into success, or vice versa, Van Putte's work is having the effect of upgrading acrylic polymers into better optical materials than the great European lens makers of yore had for fabricating their precious jewels—and a good risk for upholding the public's confidence of reasonable success in picture-taking. Our engineers in the South, who work with plastics we make, spread themselves very widely into marketing activities; Van Putte, working with plastics we buy, has done himself equal credit by digging deeper into one circumscribed but important engineering topic than we think has ever been dug before. Van Putte, born (31 years ago), brought up,

*This word has taken on a broader, more diffuse meaning in certain non-technical circles of contemporary society. Actually, we do have other concerns than plastics, whether broadly or narrowly defined.

and educated in the North, likes working in Rochester just as much as the Southerners prefer their part of the country.

How it went: Always enjoyed math, of course. Master's in heat transfer and fluid flow. First Kodak assignment doing, logically enough, heat-transfer calculations. Bountiful supply of scratch pads, easy access to pencil sharpener and computer, no extra information on big picture into which calculations fit. Proves patience for eight months. Then manufacturing technology department on consumer-goods side of house decides it too could profit from a little campus-fresh sophistication in heat-transfer analysis. Van Putte overjoyed to accept challenge.

New single-minded assignment to learn all he can about injection-molding process. At least that's how the boss's boss now remembers the assignment. Van Putte remembers it a little differently. More like "Is it the temperature that's wrong in those lens-molding machines? The pressure? Or is it the flow rate?" On a certain lucky day,

after a year or so of continuing to scratch away for data on first one of these parameters and then another, Van Putte sells a program of fundamental studies with sensors for all the injection-molding parameters and on their relation to the parameters of optical performance in the photographic lenses produced. Thixotropic nature of polymer melt properly allowed for. Feels now in retrospect it took him too long to make his program pay off. Others take kinder view, drink toasts to Van Putte's health, look forward to next phase of his work wherein he educates injection-molding machines to know about the optical performance of the lenses they turn out.

Well known fact in industry that when a program turns out well, it was the big boss's idea. Van Putte crafty enough to understand that fact. Boss also crafty. Knows better than to call in a green young engineer and tell him to make a quantum jump in technology. Even if that's what he wants done.



Technology Review, Reg. U.S. Patent Office, is published nine times each year (in October/November, monthly from December through June, and in July/August) at the Massachusetts Institute of Technology.

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Inquiries regarding editorial contents, subscriptions, and advertising should be addressed to:

Technology Review
Room E19-430
Massachusetts Institute of Technology,
Cambridge, Massachusetts, 02139.

Area Code 617, telephone 864-6900, extension 4871.

Technology Review is printed by the Lew A. Cummings Company, Manchester, New Hampshire. Second class postage paid at Manchester, New Hampshire.

Price: \$1 per copy, \$7 per year in the United States, \$8 in Canada and foreign countries. Please allow three weeks for changes of address, and give both old and new addresses in all requests.

Technology Review is represented for advertising by:

Good, Laidley and White, 50 East 42nd Street, New York, N.Y., 10017, telephone (212) 986-6210.

Mediarc Center/New England, 710 Statler Office Building, Boston, Mass., 02116; telephone (617) 426-6762.

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In Technology Review for March:

Weather Modification and the Biosphere, by Dr. Frederick Sargent 2d—though man now contemplates changing the earth's weather and even its climate, he knows little of what success may bring.

Agro-Industrial Complexes, by Edward A. Mason—how increasingly efficient nuclear reactors can be the focus for remarkably productive complexes of industrial and agricultural enterprises.

In Technology Review for April:

A special issue on computers in modern society. Authors will include Daniel Bell, Professor of Sociology, Columbia University; Jay W. Forrester, Professor of Management, M.I.T.; Joseph Weizenbaum, Professor of Electrical Engineering and of Political Science, M.I.T.; and others.

The Cover

The moon's back side, never before seen by human eyes, fills most of the cover photograph made from the Apollo 8 spacecraft during its return journey to planet earth. For an account of how human skills and modern technology combined to make possible the epic journey of Astronauts Anders, Borman, and Lovell, see page 40.

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A New Mover for Science

Maybe I'm reading too much into it. But I think there's a connection between the broad smile William Pickering wears these days and the arrival of Lee DuBridge in Washington.

As President Nixon's science adviser, Dr. DuBridge is ready to battle for stronger support of a vigorous American science program. And, as head of the Jet Propulsion Laboratory, Dr. Pickering now talks optimistically about the future of planetary exploration, a field with which J.P.L. is particularly concerned.

Last fall, when he felt the full bite of budget cuts, Dr. Pickering had been cutting back staff. He wondered how much longer he could hang on to key men. Now he says the cutbacks are over. He even looks forward to some expansion, foreseeing new support for planetary research.

Actually, the complexion of the new Congress is indistinguishable from that of the Congress that made the cutbacks. But Dr. Pickering senses a favorable wind of change with the new administration.

He may well be right. With the coming of Richard Nixon and Lee DuBridge, the cold, unsympathetic climate for scientists in Washington may be softening. Former science adviser Donald Hornig tried hard to make the case for research. But his own boss seems never to have understood or fully sympathized. It's hardly a wonder that, when the budget crunch came, the administration Dr. Hornig served failed to shield American research from the ax. Funds will, of course, remain tight. But, unlike his predecessor, Dr. DuBridge feels he has a sympathetic boss.

On two occasions before leaving for Washington, Dr. DuBridge was bullish on the subject. "Our views," he said of Mr. Nixon, "are very close indeed." And if Dr. DuBridge correctly reflects the Nixon viewpoint, the new administration will fight for more vigorous support of basic science and space exploration.

The kind of meat-ax cuts the last Congress made, such as slashing 20 per cent of National Science Foundation money, have hurt university research

badly. Many projects have been crippled if not stopped. Grants already approved can't always be funded.

These cuts, coming on top of steadily contracting research support over the past several years, have forced some previously solvent universities into the red. Many sections in physical science departments, especially, have found themselves suddenly without support. This is the kind of decay Dr. DuBridge wants to stop as quickly as possible.

"Mr. Nixon has said he feels reductions made in the budget for basic research over the past year are a mistake, and I agree," he remarked. He added later that while "it's too early to predict what all the major challenges will be . . . it's already apparent that we must improve the budget for basic research in the universities."

Dr. DuBridge thinks this will be more a matter of persuasion than of finding large amounts of new money. The few billion dollars needed for basic science are a small fraction of the federal budget. Cutting them has been more a token of Congressional dissatisfaction with program justifications than an effort to save substantial funds.

In saying this, Dr. DuBridge highlighted what may be the single biggest problem of his new job—the breakdown in communications between legislators and the public on one hand and the scientists on the other.

Jargon and Hedgehogs

Dr. DuBridge admits the communications gap. He says it's partly due to the need for scientists to use special terms in talking about their work. You can't discuss the atom without bringing up neutrons or protons. It's hard to talk about genetics without mentioning DNA. And so it goes. Laymen, Dr. DuBridge observed, often hear nothing but jargon when scientists talk.

He also sees a deeper aspect to the problem. "It's hard," he says, "to explain to laymen why it's important to look into the sex life of an amoeba or a hedgehog. It's hard to explain that the underlying genetics are common to all of life."

Many people think scientists are being frivolous when they study such things. Yet if you understand the heredity principles in peas, you have a better grasp of them in people. And you can get the basic knowledge more easily and cheaply from peas or sea urchins.

Dr. DuBridge likens scientific knowledge to a building in which every wall, truss, and weld are important. "The whole objective of science," he says, "is to fill in the pieces of this incomplete structure of knowledge. Some of the pieces are small. They may, however, be like the horseshoe nail for want of which the kingdom was lost."

To Dr. DuBridge, the compelling wisdom of this argument seems self-evident. If only it can be made clear to Congress, he seems to be saying, the funding inadequacies will be corrected. The trouble is, Congress has other things on its mind than simply justifying research broadly.

Facilities vs. Geography

For one thing, many Congressmen and Senators are as interested in spreading research money around the country to their home districts as they are in seeing that it gets to the best scientists. Dr. DuBridge takes to this spread-the-wealth approach with uneasy grace.

"Funds," he says, "should be distributed to good scientists wherever they are, and good science projects should be supported wherever they are. I hope these will be found more and more widely around the country and, to some extent, they are."

"Yet the fact remains that there are only about 150 out of 2,000 colleges and universities which have graduate schools and facilities to do research. Funds have to follow the people. You can't do science without people. So simply to distribute funds on the basis of population is not very sensible because the scientific population doesn't happen to coincide with the general population."

Then, too, Congress has been increasingly concerned with the need to set priorities for research and technological spending. Unhappiness over this was at

cost of \$200 million which could be spent down to \$100 million and is expected to cost \$200 million by 1975; the continental shelf reactor, \$200 million; the first generation study, \$175 million; and the continental shelf laboratories, \$500 million. The commission forecasts spending \$300 million on test ranges and other shore facilities and about \$450 million on laboratory equipment and operations.

Many observers, among them Paul Fye, Director of Woods Hole Oceanographic Institution (which might well become one of the proposed National Laboratories), think these cost estimates are too low. The Commission itself did not hold out too strongly for their accuracy.

least partly responsible for the research cuts last fall.

Again, Dr. DuBridge acknowledges that this is a problem. But he has confidence in the present advisory set-up to solve it. In this, the President's Science Advisory Committee (P.S.A.C.) provides an independent critique while the Federal Council on Science and Technology looks at federal science from within.

Some critics think this system is not sufficiently tough to make the hard recommendations of how to slice the research pie. Some urge creation of a new Department of Science to do the job. Dr. DuBridge dismisses the notion with the observation that "many agencies use typewriters but I don't see a need for a secretary of typewriters."

The People's Stake in Science

Part of the priorities argument turns on the question of whether some of the billions going for military and space hardware should be spent on projects directly related to people. Dr. DuBridge says he hears the call for more "people-oriented" research. But he's not sure just what that means. He notes the P.S.A.C. committees already are taking hard looks at what science and technology might do to help solve problems of the cities and of a deteriorating natural environment. And, he asks, "What is technology if it isn't for people? There's much in biomedical research now that's directly people-related."

As for military development, he points out that a modern defense needs highly advanced technology. "Making the country safe is certainly a service to people," he says.

"And," he adds, "the space program is a great new human adventure, breaking chains that have bound people to earth all these years. The whole history of science is, in the long run, a demonstration that new knowledge eventually has value for people. You can't always foresee just how and when the knowledge will pay off. But there's ample evidence that it does. Then there are the practical benefits already being realized from space—benefits from weather satellites, communications satellites."

... guided and supervised by State ... scientific ... provides a central point in the Federal government to which industry can look for advice, cooperation and some kinds of support in industrial marine enterprises.

The Commission said that "basic theory, experimental techniques, equipment and even personnel are much the same for both atmospheric and oceanographic agencies."

N.O.A.A., the Commission argued, must be big.

"The Federal agency charged with maintaining the national ocean program must be of a size and scope."

So, in Dr. DuBridge's view, space research is for people because it includes exploration, acquisition of new knowledge, and practical benefits. "I'm an enthusiast for a really solid space program," he says. And that "solid" program includes a healthy role for manned flight. Dr. DuBridge notes that Apollo 8's circuit of the moon "gave tremendous uplift to the human spirit all over the world . . . the idea you can conquer the solar system is a great new event in human history."

"Now that the technology is available," he explains, "men will be exploring space. They will be exploring the solar system and making detailed studies of the moon. In many cases their objectives can be reached by unmanned, instrumental exploration. However, there will always be cases where one comes to the limit of whatever man can do. I'm sure there will be a continued program of manned flight."

However, Dr. DuBridge wants any manned flight program to be based, this time, on a tough assessment of objectives. He calls the start of the Apollo program to put men on the moon next year "obviously . . . a political decision."

As technological enterprises go, he thinks the Apollo program now "is in great shape." He says, "there will be things learned that can't be learned from instruments alone, especially when astronauts bring back a piece of lunar rock. It will be a fruitful scientific mission. No one pretends it's primarily a scientific mission, though. It's prime purpose is prestige." He adds that "from now on . . . it will be necessary to plot carefully the objectives for our programs."

In all he has said so far, Dr. DuBridge gives the impression of an articulate scientists' spokesman who is determined to build bridges to the politicians without compromising the scientists' position. Looking ahead to the challenge of his job, he observes, "We never reach a plateau in science and engineering . . . we always find more than we had last year." Now that he's in Washington, he'll be doing all he can to move American research off the plateau of government support on which it got stuck last year.

Spanning the communications gap between scientists and laymen—especially Congressional laymen—is a vital task of President Nixon's Science Adviser Lee A. DuBridge. Fortunately, says Dr. DuBridge of Mr. Nixon, "our views are very close indeed." (Photo: Wide World)



Robert C. Cowen is Science Editor of The Christian Science Monitor. He holds degrees in meteorology from M.I.T., and he is a Past President of the National Association of Science Writers.

The Oceans: A Majestic View

The United States has been given an unusually clear-eyed yet dramatic view of its future in the oceans by the U.S. Commission on Marine Science, Engineering and Resources.

The report of this Commission, which worked for two years under the chairmanship of Julius A. Stratton, President of the Massachusetts Institute of Technology from 1959 to 1966 when he became Chairman of the Board of the Ford Foundation, offers a majestic substitute for many years' worth of fevered prophecies about vast new wealth which would flow swiftly from expensive ventures in marine technology.

In the view of the Stratton Commission, the benefits will come more slowly than many expect, but perhaps more surely. Its proposed 10-year, \$8 billion U.S. government contribution would develop the technology and the scientific knowledge without which the later industrial exploitations would be insecurely based.

The Commission's report, completed just before President Johnson and Vice President Humphrey (Chairman of the National Council on Marine Resources and Engineering Development) went out of office, urges a number of large-scale technological projects: submarines able to maneuver easily down to 20,000 feet below the surface, capability for divers-engineers to operate on a sea bottom as deep as 2000 feet, laboratories for as many as 150 men on the continental shelf, a nuclear power reactor there, and a feasibility study in a moderate-sized lake of the technology needed to revive the moribund Lake Erie.

The Commission makes many other recommendations to begin to clear the way toward maximum economic utilization of marine resources while creating stronger mechanisms for enforcing conservation of those resources and a decent respect for the amenities.

The Federal Power Commission is urged to review its rate-setting procedures and tax write-off rules to encourage oil and gas pipelines to go further offshore.

The Commission urges that the Secretary of the Interior be given powers to grant

non-competitive leases for mineral-bearing areas which are far enough offshore to make them, in effect, research and development areas. The same power would be granted for leases to exploit minerals on the sea bottom which cannot compete economically until perhaps the year 2000 because of adequate supplies ashore. In any case, it is urged that the U.S. government give longer advance notice of its leasing plans.

To help modernize and rationalize U.S. fishing fleets, the Commission recommends the simple step of abandoning the "buy American" policy for fishing vessels, enforced now with laws that forbid fishermen to register foreign-built vessels here or to land fish directly in non-U.S.-built ships. The Commission argues that this step would be simpler than trying to patch up the present U.S. program of subsidies for new fishing vessels, which it says do not work well because they aren't generous enough, fail to provide for retiring old vessels at the same time, and aren't given anyway unless a showing is made that the grant of a subsidy to one fisherman doesn't harm others in the same fishery.

In addition to this, the U.S. is urged to move swiftly toward international quotas on such fisheries as Atlantic cod and haddock. The idea in the Atlantic would be a 15 to 20 per cent reduction in effort all around, reducing the danger of over-fishing and also giving the government leverage for a rationalization of the cod and haddock fishing fleet.

New State and Federal Responsibilities

To make a start on the immense task of reconciling conflicting uses of the coastal zone, the Commission urges that the states be given clear powers to establish Coastal Zone Authorities. These authorities, of which there might be more than one in a single state or which might extend over several states through interstate compacts, would have the power of eminent domain and licensing. They would be supported in their early years with federal funds and by a network of Coastal Zone Laboratories which would function much like agricultural extension services. There would be federal supervision of the standards of the Coastal Zone Authorities.

The U.S. Government is urged to go deeper into the business of developing machines and techniques for fishing vessels and submarine mining, using the now-tested mechanism of developmental contracts with industry.

To strengthen the university base for marine science, the Commission urges establishment of perhaps four University-National Laboratories and a generally expanded program of institutional support.

The services for monitoring and predicting the movements of the sea and atmosphere would be rationalized and expanded under the Commission's plan.

The Stratton Commission report makes it clear that the time has come for leadership in marine technology to pass from the Navy and its military needs to the civilian sector. The Commission emphasizes that it does not think this can be done without the creation of a strong, independent agency reporting directly to the President.

The organization would be called the National Oceanic and Atmospheric Agency, the much-discussed "wet N.A.S.A." The N.O.A.A. would start off with a budget of about \$800 million a year and expand to \$2 billion in 1980. It would group the Coast Guard, the Environmental Science Services Administration, the Bureau of Commercial Fisheries and several other agencies into an organization with 55,000 employees, 29 existing shore laboratories and 320 ocean-going vessels.

The projection of N.O.A.A.'s budget is based on its being the chosen instrument to begin most of the ambitious new ventures in technology and an arbitrary calculation that the existing programs of the agencies which would form N.O.A.A. would expand at 7 per cent per year.

The Commission's figure of \$8 billion applies only to new, civilian efforts in the oceans. It calculates that these new expenditures would start off at the level of about \$650 million a year and rise to about \$1 billion in 1980.

Among the major projects, the develop-

ment of submarines which could operate down to 20,000 feet is expected to cost \$285 million by 1980; the continental shelf reactor, \$230 million; the lake restoration study, \$175 million; and the continental shelf laboratories, \$500 million. The commission foresees spending \$500 million on test ranges and other shore facilities and about \$860 million on laboratory equipment and operations.

Many observers, among them Paul Fye, Director of the Woods Hole Oceanographic Institution (which might well become one of the proposed National Laboratories), think these cost estimates are too low. The Commission itself did not hold out too strongly for their accuracy.

Large Problems and Broad Agency

It seems that the Commission's recommendations have a good chance of acceptance. Dr. Stratton has a good deal of prestige and so do many other members of the Commission, chosen to represent most major oceanic interests. The Commission also had four strong "Congressional advisers," Senators Warren G. Magnuson of Washington and Norris Cotton of New Hampshire and Representatives Alton A. Lennon of North Carolina and Charles A. Mosher of Ohio.

Nonetheless, it is certain that there will be a great deal of argument over the Commission's central recommendation that N.O.A.A. be set up immediately. There will be disagreement about which units should be transferred to it, and many will argue that the individual recommendations of the Commission can be carried out with the existing structure. It will also be argued that the Environmental Science Services Administration was set up only three years ago and has not had time enough to prove its limits.

Mindful of this potential opposition, the Commission spent a good deal of space in its report, which ran to 570 pages of triple-spaced typescript, to arguing for N.O.A.A.

"The present Federal organization cannot meet the changing, broadening aspects of marine affairs," the Commission said. The new agency, according to the Commission, should gather functions having to do with the atmosphere as well as the oceans and take over much of the co-ordination now done by the Marine Council in the White House.

"Strength at the Presidential staff level cannot compensate for weaknesses in the agency operating structure.

"A new, strong Federal focus for marine activity is essential to a national effort. The organization should direct a civil program to the Nation's economic and social needs, conducting the scientific, technological, and management programs required to ensure that those needs are met.

"The organization should serve as

stimulus, guide and supporter for State marine activities and provide a central point in the Federal government to which industry can look for advice, co-operation and some kinds of support in industrial marine enterprises."

The Commission said that "basic theory, experimental techniques, equipment and even personnel are much the same for both atmospheric and ocean studies" and so should be grouped in a single strong agency.

N.O.A.A., the Commission argued, must be big:

"The Federal agency created to implement the national ocean program must be of a size and scope commensurate with the magnitude, importance and complexity of the problems it seeks to solve, the services it seeks to render, and its potential contribution to the well-being of society."

To get new things done, the Commission said, a new agency is needed:

"New programs must be created, and it is important that there be in the Federal government an agency with a sufficiently broad mission and capabilities to provide for their initiation and guide their development."

The N.O.A.A. should report directly to the President, like N.A.S.A. and the Atomic Energy Commission, and, if possible, it should answer to a unified oceanic committee in each house of Congress. To help it, the agency would have a new National Advisory Committee for the Oceans.

"Piecemeal solutions are not sufficient. It is necessary to place together the central civilian functions under single management in order to have a coherent effort," the Commission argued.

"Reorganization cannot be a substitute for new programs, but neither can programs be launched with maximum effectiveness through our existing machinery of government."

Avoiding Overambition

Throughout its report, the Stratton Commission makes it clear that it does not see the need for a "crash" program in the oceans. It backs up this assertion by suggesting a program of new efforts only a third the size of the Apollo lunar landing program (which is to cost about \$24 billion).

The National Aeronautics and Space Administration's job, which is similar to that of military weapons development, has been to start something almost brand-new and build up very rapidly.

The Stratton Commission's \$8 billion proposal has a contrasting aim: "to emphasize and rationalize programs which, for the most part, are already in existence and which are already returning benefits to our people."

The build-up of money, the Commission report emphasized, "should take place at a rate which can be sustained. Attempting too ambitious a start could cause the program to face erratic support in later years." This is precisely the difficulty which has beset N.A.S.A. in seeking support for earth-orbiting laboratories and lunar exploration to follow the first Apollo landings.

Furthermore, the seas and the ocean of air that interacts with them are "vast, complex, subtle and often hostile to man and his works," the Commission argues. "They will not yield their secrets in a decade or a generation. . . . The Commission notes with misgiving the recent tendency to condition Federal support of science on a prospect of imminent, tangible results of economic value."

Time after time, the Commission stresses that much-discussed immediate pay-offs from the sea are likely to be illusory. Time after time, the report steps away firmly from rash promises which will only strengthen skepticism later and harm a sustained drive into the oceans.

The main contribution of sea fish to the world food problem, the Commission notes, is to enhance the supply of protein. The world's requirements for calories must be supplied from land. The work on fish protein concentrate opens up economic utility for many new varieties of fish not now exploited, the Commission says, but it will not be the main reason for a revived American fishery.

In speaking of marine minerals, the Commission said it "rejects the idea that self-sufficiency in natural resources is a desirable goal for American policy." Instead, the Commission suggests, wherever possible, an international approach to exploiting fisheries and submarine minerals. "The oceans wash impartially the shores of most of the world's nations, whose interest in uses of the sea mirror ours."

Still, "consumption of metals in the next 35 years is expected to exceed that of the last 2000 years. Energy use in the next 20 years is estimated at three times that of the last 100 years." A sixth of the world's oil and gas comes from continental shelves now, and the figure is expected to be one third by 1980.

Furthermore, there are uncertainties about the rate of use, the technology of re-use, the politics of many countries. For this reason, the Commission argues for a modest start now on developing alternative sources of supply in the sea around the United States.

Eloquently, comprehensively, the Stratton Commission has given the nation a base on which to make sound policies for understanding and exploiting the oceans.

Victor K. McElheny is Science Editor of The Boston Globe and formerly was European Editor of Science magazine.

Concorde: Europe's Supersonic Politics

The supersonic airliner Concorde—affectionately known in Europe as the 'capricious daughter of a shotgun marriage'—means much more to the British and the French than just a new and probably highly profitable airliner. Lacking the mind-stealing spectaculars such as *Apollo* or *Sealab*, many Europeans have been frustrated with the mundane. And it is here that Concorde has stood out as a bold and imaginative exercise in advanced technology.

It was with very mixed motives that the two countries agreed to collaborate on Concorde in the first place. To France the reasons were bound up with *la gloire*; to Britain they were part of a diplomatic gesture designed to warm the hearts of frosty Common Marketees. The airplane that the politicians and engineers were discussing in November, 1962, was an ogival-winged 100 seater with a weight of 260,000 pounds, capable of flying at more than twice the speed of sound. It was to be powered by four Bristol Siddeley 'Olympus' engines and the airframe was to be constructed largely of aluminum alloy. The last point is important, for it limited the cruise speed to Mach 2.2 (about 1450 mph)—the temperature-stress limit of the wing and fuselage skins—and meant that the Anglo-French team was committed to an essentially 'conventional' airplane. (Later, when the United States entered the supersonic transport business, the F.A.A. demanded that titanium alloy be used extensively in their aircraft, so that it could fly at nearly three times the speed of sound.)

The Weight and Cost Spiral

Since those early days Concorde has grown considerably; today the aircraft is fitted with between 132 and 140 seats and is capable of carrying passengers from Paris to New York against severe head winds and there divert, if necessary, to Chicago or further. To meet this increased performance, Concorde's weight has spiraled up to 374,000 pounds.

Escalation has also been a recurring theme on the cost side. From an initial "around £160 million" (then about \$450 million), the total cost of the project—

which is shared equally by France and Britain—jumped first to \$700 million in May, 1964, then to \$1.1 billion in February, 1966. Today the figure stands at \$2.25 billion. However, it is not strictly fair to compare costs in this way: for one thing, the current Concorde is a considerably 'stretched' version of the original design; for another, the deal now includes a far more realistic prototype construction program.

The most expensive item has been the research and development—a program which started in 1962 and is funded until 1973; this will ultimately amount to some \$1.37 billion. Included is the cost of construction of two complete airframes for testing (one for fatigue studies at the Royal Aircraft Establishment, Farnborough, and the other for static tests at Sud Aviation's Toulouse plant), plus four fully instrumented flight aircraft, 63 Olympus engines, all the jigs and tools needed for production, and some 4300 hours of flight testing, along with the research and development carried out by the couple of hundred subcontractors involved.

The next largest sum is a loan of \$600 million guaranteed by the two governments which will be used to bridge the gap between the beginning of production on the fleet aircraft and the time when income starts rolling in from customers. Finally, there are two sums of about \$150 million each, one of which will buy special advanced tools for loan to subcontractors and the other of which will pay for the aerodynamic and aeroelasticity studies on Concorde which have been undertaken at various institutes in the two countries.

Mixed Bag Construction

Although the first prototype (001) was assembled at Toulouse and the second (002) at Filton near Bristol, there is no such thing as a wholly 'French Concorde' or 'British Concorde'. The project is in every sense a joint one, with two identical production lines and a peculiarly mixed bag of manufacturing arrangements. For instance, the forward airframe from the 'droop snoot' to the leading edge of the wing is built at B.A.C.'s Weybridge and Marshalls facilities; the intermediate fuselage and

wing are made at Sud's Marignane, Bougenais and Toulouse factories; the air intakes, engine bays and nacelles are manufactured at Filton; and the rear fuselage, rudder and fin come from Weybridge. The undercarriage units are assembled by Messier (nose wheel) and Hispano Suiza (main gear) in France and the Olympus 593 gas turbines rated at 35,000 pounds of thrust come from Rolls-Royce (Bristol), with some manufacturing assistance from S.N.E.C.M.A. in France. Equal numbers of the various components are dispatched to the two main production facilities, where final assembly then takes place in parallel.

Early this spring, flight data from 001 will be 'read across' to the second prototype so that any control or performance problems that may occur can be corrected and the modifications incorporated into 002 before it takes to the air. The two aircraft will then share the load of the extensive flight testing program while two more test aircraft are built. The aim is to achieve a full airworthiness certificate within two years so that commercial operations can begin in 1971. With the U.S. (Boeing) supersonic transport design in the hands of the F.A.A., the Anglo-French consortium is especially anxious that no hitches develop during the certification trials.

Production plans are geared to putting 17 Concorde into service by the end of 1971, and 40 by the end of 1972. On the transatlantic run Concorde will cut existing flight times by half, bringing a typical crossing down to 3½ hours. But there will be a surcharge of anything between 15 and 25 per cent for this luxury of speed. And this will help cover the supersonic airliner's increased operating cost: at \$20 million each, the Concorde will be five or six times more expensive to buy than a current subsonic jet. However, even Concorde's arch-critics now admit that there is no reason why the aircraft should not be a notable commercial success. The B.A.C.-Sud marketing team estimates that sales could reach 250 by 1975, even assuming a total ban on supersonic flight over land. In that case, the balance-of-payments benefit to both



France and Britain, for the period while the aircraft are in service, will be of the order of \$5 billion each. And given less severe sonic boom restrictions Concorde's sales could well top the 400 mark by 1980, say the manufacturers.

Two Lessons for Europe

At root, Concorde has always been a political aircraft, and this is why such a ludicrous situation of having each country build exactly half an airplane and then swap parts is tolerated. The list of engineering absurdities is too long to mention, but a few examples will give some idea of how inefficient a 'fifty-fifty' construction program can be. For instance, every minor component—a valve, nut and bolt or a piece of cable—has to be scrutinized by a two-man committee (one French and the other English) to see which country should be allocated the work. In one particular case, a British glass manufacturer, who had already re-invented a material that was available in the U.S., was forced to abandon it when the contract was awarded to a French firm, who then had to invent the product for yet a third time.

However, for all its drawbacks, Concorde has shown Europeans that international collaboration on large technological projects can work. The lessons are (1) that success is more likely to come when collaboration is between two rather than three or more countries;

and (2) that design leadership really has to be given to one of the parties involved. (Thus Britain conceded to France the design responsibility and most of the work on the new Jaguar fighter/trainer which will shortly enter service with the Royal Air Force and the French Air Force.)

Though not planned, Concorde has also proved useful to both Britain and France as a means for 'matching' their aircraft industries. Since World War II, Britain's excessively large aviation industry has been far too heavy a drain on public money and skilled manpower (some 365,000 employees in the late 1950's). But since 1966 there has been a deliberate policy by the British government to streamline the aircraft industry down to a more realistic level of around 240,000 employees. Against this background, the Concorde project has been especially important to induce a meshing of large sections of the French and British industries, which in turn has given momentum to General de Gaulle's efforts to expand aviation in France (now estimated to be about 110,000 employees). Not to be left out of the aerospace scramble, the West German government has pumped large sums of money into its fragmented aircraft industry and has forced a number of successful mergers. Still in its infancy, this German aerospace effort numbers 40,000 employees and is growing fast.

The first Concorde was proudly posed for its picture in Toulouse in December. It represents "a bold and imaginative exercise in advanced technology," and it is also a crucial test case in Europe's effort toward international cooperation in higher technology.

Thus the big three in Western Europe now have a combined aviation and space technology commitment amounting to more than 400,000 men. There are, however, many outstanding problems to be solved on how to make this combined industry work with harmony and efficiency. A British Minister of State, J. P. W. Mallalieu, touched on this delicate point in a speech made at last September's Farnborough Air Show: "We need to develop our methods of joint management and work sharing and other aspects of the highly complicated business of building aircraft in several countries." He added that elements of this combined European industry could be seen to be taking embryo form, with the setting up of joint industrial companies which transcend national frontiers for particular projects. Concorde is therefore a test case; at stake is the credibility of Europe's technological revival.

Nicholas Valery is Editor of the British magazine Science Journal.

The Living Experience

Like the banished Duke in the Forest of Arden, we may find tongues in trees, sermons in stones—and texts in commonplace verbal thicket.

The owner's manual of a new automobile declares that "... a shoulder belt can provide ... protection against impact with the car interior by restraining forward motion of the upper torso in a collision. ... *Caution:* ... the use of a shoulder belt is not recommended for a person less than 4 feet 7 inches in height because the belt will cross over the body too near the neck and thereby substantially increase the danger of neck injury in a collision."

Alas, the dilemmas of living! The inescapable confusion of hazard and safety!

If the tone is tinged with a smile, the subject is nevertheless serious. Alas for short motorists! But let us save a sigh for all of mankind. The melancholy image is a metaphor for the universal human condition in our time. In more than one way, we are the wrong size for the environment in which we find ourselves.

We mean, of course, the man-made environment that has stultified men's bodies and souls for 200 years since the transformation of society began in the mines and mills of eighteenth century England. The contemporary manifestations have been catalogued often enough to be familiar: air, water, and food contaminated by industrial wastes, insecticides, and radioactive fallout; deforested lands, exhausted soils, and dust bowls; crowded, noisy, dirty cities.

The plausible folk-logic by which the social consequences of a scientific-technological revolution are blamed on scientists and engineers is also familiar. And we have become accustomed to the voices of scientists rising alone in the midst of silent philosophers and senators, poets and industrialists, teachers and merchants, plumbers and bankers, to acknowledge exclusive responsibility for conditions deplored by all.

Five hundred years ago, Leonardo da Vinci wrote in his notebooks: "How and why I do not describe my method of

remaining under water for as long as I can remain without food; and this I do not publish or divulge on account of the evil nature of men who would practice assassinations at the bottom of the seas, by breaking the ships in their lower parts and sinking them together with the crews who are in them."

The assassinations he feared are practiced from the bottom of the seas to the roof of the skies. Who will claim that it was in the power of Leonardo's scientific descendants, by withholding their brains and hands, to thwart the development of nerve gases, hydrogen bombs, bacteriological weapons, and the less dramatic environmental poisons of peacetime? To so assume a negative responsibility, concentrating, as it were, on *thou shalt not* in some Decalogue for scientists, may yield personal—but not social—salvation.

The Choices Men Make

In *So Human an Animal* (New York, Scribner, 267 pp., \$6.95) René Dubos of The Rockefeller University imposes on his colleagues and himself more exacting moral obligations, more difficult to fulfill and potentially more fruitful.

If he seems at times to take on a role befitting a biblical prophet rather than an eminent biologist, it should be said that despite his anguish and indignation at the desecration of life and nature in our society, this is not an angry book.

"Unfortunately," he tells us, "writing in anger requires talents that I do not possess." Even when, like a prophet, he is concerned with what should be rather than what is, the values he derives are based on a biologist's knowledge and understanding. "What is man?" Dr. Dubos asks, and in answering he discloses how the nature of the responsibilities he feels as a scientist arise out of the nature of man.

As in other animals, man's genetic endowment is the latest, but not the final, stage of an evolutionary process. The slowness of this process, the workings of the mechanisms of heredity, and the time scale of his life cycle give his species a high degree of biological permanence; the basic characteristics of *Homo sapiens* have not changed since

the Stone Age. "Cro-Magnon man, if he were born and educated among us, could work in an I.B.M. plant and might even become president of the company."

Genetic factors, however, are not all-powerful. They do not determine fixed traits, either in species or in individuals, for the former evolve and the latter are not identical with their parents. Heredity only controls developmental processes, which may follow one path or another, depending on the interaction of the organism with the environment. "Men resemble their contemporaries even more than their progenitors," said Emerson.

The human genetic pool remains practically constant from one generation to the next, so that rapid changes in the biological character of whole populations must be due to environmental factors. So, for example, in Western countries teenagers now reach sexual maturity earlier than did their grandparents; since World War II Japanese children have grown larger than their parents; and diseases once commonly fatal in the Western world, such as tuberculosis, have almost disappeared, to be replaced by heart diseases, lung cancer, and other ailments.

Man, then, is a creature shaped by the distant past, as it has been conserved by evolution and stored in his genes, as well as by the present environment, which favors the development of some stored potentialities over others. He changes not only in the course of thousands of years, but also in a generation, and even from minute to minute. If we know his species, his parents, and his surroundings, we may know him as we know his fellow creatures in the animal kingdom.

But what makes him so human an animal? It is simply the fact that his parents are human. Wolf-children, reared from infancy by animals, cannot always be taught to walk, eat, sleep, and make sounds like humans. Man becomes human because his genetic potential interacts not only with the natural environment but also with his social and cultural environment.

It may be that to discover the characteristics that are most distinctively human

we should consult not scientists nor even philosophers, but poets. Dr. Dubos is not so rash as to attempt a comprehensive list. He notes that man's relation to time is specifically human; he remembers the past and is concerned about the future. So also is his tendency to create symbols and then to react to them as if they were external stimuli. But most significant of all is the fact that the interaction of genetic and experiential factors is not sufficient to account for the whole of human nature. Within the limits imposed by the biological determinants, man can make choices capable of changing himself and his future. He has free will.

It is evident that Dr. Dubos is extending the realm of science beyond the boundaries traditionally fixed. The traditional scientist stops at the invisible gate, pointing out that questions of philosophy and value judgments do not belong in science and are, in any case, outside his own field of competence. Dr. Dubos spends little time on the philosophical aspects of determinism and free will. He states an empirical fact. Men do choose, and their choices affect the course of events, now and for the future.

Their choices have made a poisoned brew of the environment. Yet in the Western world, where pollution of the environment is greatest, economic systems are strong and standards of living rise. *Homo sapiens*, continuing to increase in numbers, is biologically successful in the Darwinian sense. Men and society seem to be adapting satisfactorily.

The ability to adapt is not unequivocally desirable. People born and raised in an environment where food is inadequate usually adjust by limiting their physical and mental activity. The apathy and indolence long considered to have racial or climatic origins are often a form of adaptation to malnutrition. "... The most frightening aspect of human life is that man can become adapted to almost anything, even to conditions that will inevitably destroy the very values that have given mankind its uniqueness."

Toward a New Science of Humanity
Technology is here to stay. We cannot

return to the primitive life nor can we escape to the South Seas. We must create a new environment in which the widest range of human potentialities can unfold. Even if the willingness existed, however, the necessary knowledge of man's reactions to forces in the social and natural environments is still lacking.

"Everyone agrees that all citizens should be given equal educational opportunities. But what are the critical ages for . . . receptivity to the various kinds of stimuli? What . . . are the effects of prenatal and early postnatal influences on the . . . characteristics of the adult?"

"Everyone agrees that our cities must be renovated . . . Who knows enough to tell, or who tries to discover, how the environments so created will affect human well-being and condition the . . . development of children?"

"Everyone agrees that it is desirable to control environmental pollution. But which pollutants of air, water, or food are really significant? . . . What about the cumulative, delayed, and indirect effects? Does the young organism respond as does the adult?"

Who is looking for answers to these questions? Not the biological sciences that "attempt to account for man's nature without reference to free will . . . and deliberately ignore the most important phenomena of human life." If scientists study man by physicochemical methods, they will naturally find that he is a machine made of atoms. If they make the widespread assumption that complex systems can be understood by subdividing them into simple ones, they will again reduce man to nonhuman dimensions.

A man reacts to his environment through a highly personal, selective, often creative interplay constituting what Dr. Dubos calls the *living experience*. The total environment, natural and social, together with the men and societies which are parts of it, is a vast ecological system. A new science of humanity is needed that will strive to understand man through studying the living experience and the ecological system. It will be a difficult, perhaps even an impossible, task.

The R&D Game:

Technical Men, Technical Managers, and Research Productivity
edited by David Allison

The best of the scientists and engineers in industry have fast become the *prima donnas* of their companies — and with good reason, since they have been the leaders in bringing forth the new ideas, processes, and products that have transformed the American economy. Management, in the more enlightened companies, has accordingly given them considerable autonomy to exercise their creativity in basic research. Yet management also suspects — rightly, in at least one contributor's view — that the technical men should be coming up with a higher "research payoff."

This book confronts many questions about Research & Development, and if it provides even more answers, that is all to the good at this point — a real start has finally been made.

The questions and answers are provided by a number of qualified observers, ranging from psychiatrists and social psychologists to R&D managers and marketers. Their contributions are collected in three sections, one on the nature of the technical men who staff the corporate laboratories, another on the nature of the corporate organizations themselves, and between them — forming the middle section of the book — an investigation of the environment effected by the interaction of the two. **\$12.50**

Second Order Consequences

by Raymond A. Bauer with Richard S. Rosenbloom and Laure Sharpe

This volume concentrates on the problem of managing the consequences of technological change in a broad sense, rather than on specific consequences of the space program. Even if it were possible, it would not be desirable to draw a clear line between the space program and large-scale modern technology in general. The urgent job at hand is to develop, almost from the ground up, a new methodology that is adequate in dealing with these questions that become more and more significant as society becomes more and more dependent on technology. However, the second of the three sections in this book includes, as an application of the methodology developed, an overview of the actual impact of the space program on special groups. One particular problem — the role of technicians in the manpower picture — is selected as an example to be examined in depth.

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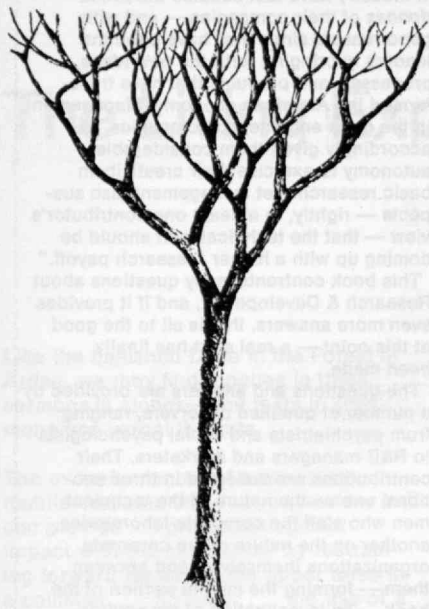
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P. B. Medawar, the British biologist, has written: "No scientist is admired for failing in the attempt to solve problems that lie beyond his competence. The most he can hope for is the kindly contempt earned by the Utopian politicians. If politics is the art of the possible, research is surely the art of the soluble. Both are immensely practical-minded affairs."

Dr. Dubos believes that "... it is a moral obligation for the scientific community to devote itself in earnest to the study of ecological systems, both those of nature and those created by man. . . . In addition to the science of things, scientists must create a science of humanity, if they want the intellectual implications and practical applications of their efforts to be successfully woven into the fabric of modern life."

It is not certain that Medawar is the more practical man.

New from the M.I.T. Community

Project Icarus, Louis A. Kleiman, '65, Editor. Cambridge and London: The M.I.T. Press, \$6.95. If the asteroid Icarus had in fact been on a collision course with earth—instead of its 4 million miles distance—in June, 1968, what could man have done to prevent the awesome catastrophe? This question was given to 21 M.I.T. graduate and undergraduate students enrolled in 16.74, Advanced Space Systems Engineering, in the spring of 1968; *Project Icarus* is their report.

1969 Britannica Yearbook of Science and the Future. Chicago: Encyclopaedia Britannica, Inc. To "Science Year in Review," a comprehensive summary of the principal scientific events of 1967-68, the editors have added a series of 14 essays on current fields of special interest, written to be understood by laymen. Among authors of the latter is Frank Press, Head of the M.I.T. Department of Geology and Geophysics, who summarizes man's growing knowledge—but yet vast ignorance—of the earth's structure, its seas, and its atmosphere. There are also inadequate sections on careers in science and on likely scientific developments in 1969.

Malnutrition, Learning and Behavior, edited by Nevin S. Scrimshaw, Head of the M.I.T. Department of Nutrition and Food Science, and John E. Gordon, Senior Lecturer in Epidemiology, M.I.T. Cambridge and London: M.I.T. Press, \$12.50. The proceedings of an international conference on the subject held at M.I.T. in March, 1967 (see *Technology Review* for May, 1967, pp. 23-27).

The Strategy of Puts and Calls: Selling Stock Options for Maximum Profit with Minimum Risk, Zaven A. Dadekian. New York: Corinthian Editions, 1968, \$4.95. Mr. Dadekian, who graduated from M.I.T. in 1955, is Vice President—Research and Development and a Director of Baird Industries. His profitable avocation—

option writing—is now five years old, and this book describes his system and his success.

Reflections on Men and Ideas, Giorgio de Santillana, Professor of the History and Philosophy of Science, Emeritus, M.I.T. Cambridge and London: The M.I.T. Press, \$15. A collection of essays ranging from the pre-Socratics to contemporary thought and representing Professor de Santillana's analysis of the great periods in the history of man's ideas.

Greek Mathematical Thought and the Origin of Algebra, Jacob Klein. Cambridge and London: The M.I.T. Press, \$12.50. A new history of Greek and Renaissance mathematics demonstrating the author's concept that ancient and modern mathematics (and therefore science) are distinguished by a crucial change in the concept of number which occurred during the Sixteenth Century.

Energetics in Metallurgical Phenomena, Volume IV, William M. Mueller, Editor. New York: Gordon and Breach, \$19.50 (cloth), \$12.50 (paper). Proceedings of a seminar of the same title held at the University of Denver in 1965, with chapters by Carl Altstetter (M.I.T. Sc.D.'58) and Reinhardt Schuhmann, Jr. (M.I.T. Sc.D.'38).

Work Hardening, J. P. Hirth and J. Weertman, Editors. New York, London, and Paris: Gordon and Breach, \$23.50. Papers from a symposium sponsored by the Chemistry and Physics of Metals Committee of the Institute of Metals, A.I.M.E. held in Chicago, Ill., in November, 1966, with a chapter co-authored by Charles J. McMahon, Jr. (M.I.T. Sc.D.'63).

Energy Bands in Metals and Alloys, L. H. Bennett and J. T. Waber, Editors. New York, London, and Paris: Gordon and Breach, \$13.50. Papers based on a symposium of the Committee on Alloy Phases of the Institute of Metals, A.I.M.E., in Los Angeles in February, 1967, with one chapter by John C. Slater, Institute Professor Emeritus, M.I.T.

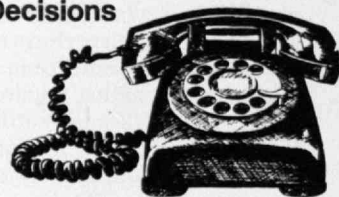
Structural Ceramics and Testing of Brittle Materials, Samuel J. Acquaviva and Seymour A. Bortz, Editors. New York: Gordon and Breach, \$19.50. The proceedings of a seminar on the same subject held at Illinois Institute of Technology in March, 1967. Frank A. Halden (M.I.T. Sc.D.'54) is coauthor of a chapter on "Static and Cyclic Fatigue of Alumina."

Joseph Mindel is a member of the M.I.T. Lincoln Laboratory. (The notes "New from the M.I.T. Community" have been prepared by the Editors of *Technology Review*.)

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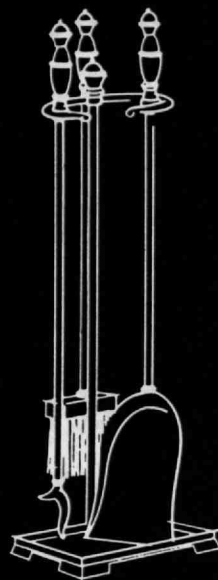
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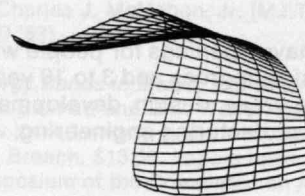
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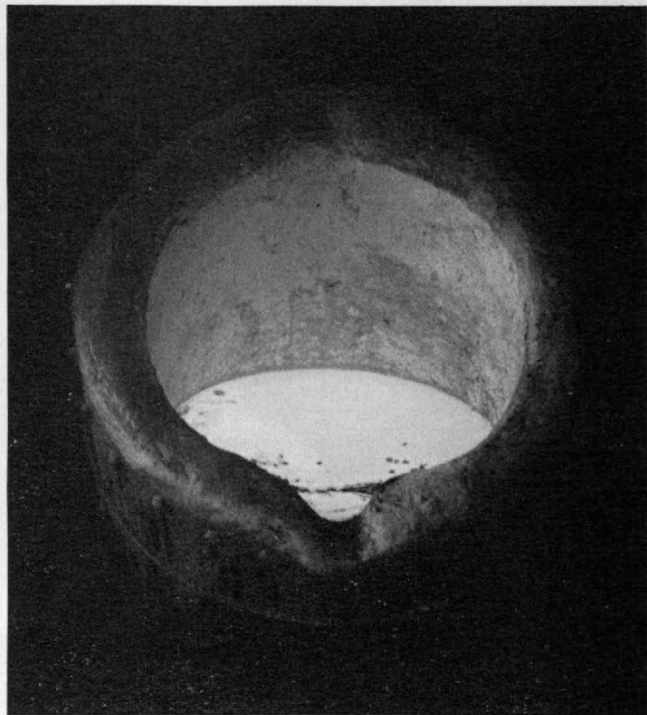
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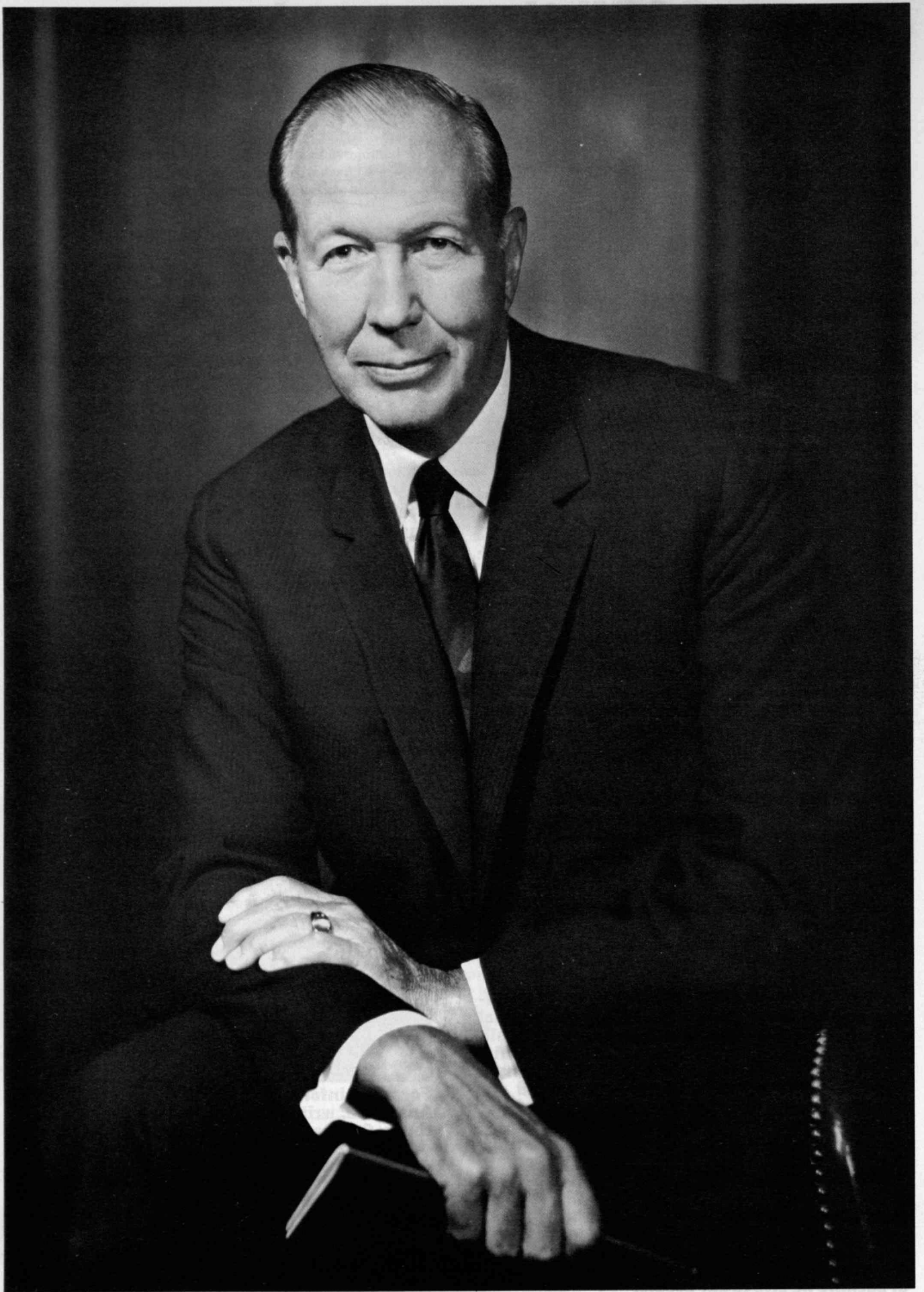


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Technological change at once threatens the world disarmament effort with new uncertainties and suggests the urgent need to extend our successful efforts in international understanding

William C. Foster
Former Director, United States Arms Control
and Disarmament Agency

The Arms Race: Danger and Opportunity

Following the painful abandonment, in the 1950's, of our early efforts to set up a system of international control over nuclear weapons, there came a period of increasingly nervous confrontation between the United States and the Soviet Union. This nervousness was fed not only by uncertainty on each side as to the other side's intentions, but also by the nature of the nuclear weapons which then existed. The weapons of both adversaries were "soft," vulnerable; thus they appeared to provide a tempting target for a pre-emptive *first strike*.

With improvement both in technology and in understanding of the dangers of such weapons systems, the United States and the Soviet Union both moved slowly away from this position. Both sides gradually evolved invulnerable, secure, second-strike forces which could ride out an enemy's first strike and still be able to retaliate with unacceptable damage, thereby eliminating any incentive on either side to strike first, in addition to deterring the adversary from striking at all.

We and our allies—and the Soviets—are still the beneficiaries of this less-than-perfect but relatively stable configuration of mutual deterrence.

For how long?

Any situation of rivalry has built-in dynamism; and, as former Secretary of Defense Robert S. McNamara pointed out while he held that post, even *potential* actions on one side can produce reactions on the other. For example, early in this decade we thought the Soviets *might* deploy large numbers of I.C.B.M.'s, and so we deployed large numbers ourselves—far more, in fact, than we actually required. The Soviets, in anticipation of an improved U.S. bomber capability, deployed a new air-defense system to cope with it. Perhaps in response to our extensive I.C.B.M. deployment, the Soviets also have been moving ahead rapidly with I.C.B.M.'s. In addition, they began the deployment of an A.B.M. system—to which we are now responding with the development of MIRV's, or Multiple

Independently-Targeted Re-Entry Vehicles—several independently targeted warheads launched from the same missile. They also may well be developing MIRV's. And if they were to consider our A.B.M. system as ultimately directed against them rather than against the Chinese (as some American leaders have indeed given them to believe), they might feel that this was a reason to *deploy* MIRV's (so as to be sure they could penetrate our A.B.M. system). On the other hand, if they resume A.B.M. deployment, this would provide an additional impetus for our MIRV program. And so on.

Although this action-reaction arms race has been going on for quite a long time, it is difficult for us to adjust to its implications. As Americans we are notably *unfatalistic*, and it is our natural inclination to think that somehow we should be able to get ahead. And yet the other side, perversely, refuses to stand still. As a matter of national pride we would seek "superiority" . . . and yet it eludes us. Worse than that, even the *idea* of overall superiority has become elusive, since either side, after absorbing an enemy first strike, could still inflict about 100 million casualties on the other side.

As mentioned, this action-reaction phenomenon is not new; but we have reached a point in the process which *is* new—a point where we are in danger of losing the relative stability we have enjoyed in the mutual-deterrence configuration. Let us consider, as an example, what might happen if each side deployed both a full-scale A.B.M. system in which it had reasonable confidence (whether justified or not) and a full-scale MIRV system, each element of which contained, for example, five accurate and separately targetable warheads. In a crisis situation, one side (or the other) might be tempted to launch a pre-emptive first strike, according to the following rationale: since the enemy's land-based missile system was similarly equipped with MIRV's, every 10 missiles (each equipped with five accurate MIRV's) fired at it could, at least theoretically, take out up to 250

enemy warheads. With the ability to reduce the enemy's offensive forces on such a ratio, its remaining potential retaliatory strike could readily be reduced to presumably "acceptable" proportions by a large A.B.M. system.

Given the devastation which even a few penetrating missiles could wreak in a retaliatory strike, the launching of such a first strike does not seem a very reasonable idea. But remember that it is a crisis situation we are talking about, in which each side is worried that the other might do just that. With this expectancy in mind, the risks to population from initiating such a strike might appear less than the risks of not doing so.

Advocates of these sophisticated weapons systems—the A.B.M. and the MIRV—have argued in favor of their "damage-limiting" capabilities; and the argument has superficial merit. If the MIRV could take out enemy offensive forces before they could be launched, and if the A.B.M. could shoot down enemy missiles before they reached us, would this not save American lives? Unfortunately, as illustrated in the crisis situation described above, their possession would increase the danger to human lives by increasing the likelihood of nuclear conflict. Moreover, with an arms race between A.B.M. deployment on one side and the deployment of extra offensive missiles (with which to penetrate the A.B.M.) on the other, the level of net destruction of human life could very well rise.

In the final analysis, the only sure way to avoid massive destruction of life in a nuclear war is to avoid the war.

New Uncertainties

Another important reason for wishing to negotiate a halt in the nuclear arms race at this point in its upward climb is the fact that, otherwise, some very troublesome uncertainties will appear in the equation. If either side deployed a full-scale A.B.M. system, what new offensive forces would be needed to counter it? If either side deployed MIRV's, could one differentiate them from ordinary single-warhead missiles without unacceptably close inspection? And if either side deployed mobile land-based missiles (another possibility), how could one keep track of them even with such close inspection?

The desirability of engaging in discussions with the Soviets in an effort to limit the strategic arms race before we move into the next phase of it thus should be quite apparent. Moreover, our capabilities for verification of possible arms control agreements have greatly improved over the years; and it should not be too difficult, in the present context, to arrive at agreements which would not only enhance our

national security but also spare us a grievous waste of resources.

In other words, technical considerations argue irrefutably in favor of pursuing arms control negotiations with the Soviet Union. Indeed, if these were the only considerations involved we could probably solve our problems rather handily. Mutual limitations on strategic offensive and defensive weapons systems could be followed by mutual reductions in those systems. Then we could move on rather readily to such additional measures as a comprehensive test ban, a cutoff in the production of fissionable materials for weapons, and so on.

Can We "Do Business" with the Soviet Union?

However, there are many political factors which intrude upon the scene, the first of which stems from the nature—and plight—of the Soviet regime. It is my own feeling that we will continue for a long time to have extremely difficult relationships with the Soviet regime, which is fighting a rear-guard action against an imposing array of technical, economic, and political facts of life. Perhaps, as time goes on, it will feel an even greater need than before for the Orwellian "external enemy" in order to maintain itself in power. Under these circumstances, can we really hope to "do business" in arms control?

The first part of the answer lies in the fact that we already have been doing business, and quite a lot of it. Since 1959 we have had the Antarctic Treaty, providing for the preventive denuclearization of the subcontinent. This may not have seemed like a very spectacular development at the time; but we have come to realize increasingly how important it is to keep nuclear weapons out of inaccessible areas before they become accessible, rather than trying to get them out afterwards. Moreover, the Antarctic Treaty has enabled us to carry out inspections of Soviet installations in the subcontinent—a most valuable precedent. Since 1963 we have had the limited test ban treaty, prohibiting all nuclear tests except underground. In that same year we negotiated the Washington-Moscow "Hot Line," which has already served to remove uncertainties in a critical time. Since 1967 we have had the Outer Space Treaty, analogous in many respects to the earlier Antarctic pact. And in 1968, together with the Soviet Union and many other countries, we brought to fruition the nuclear Non-Proliferation Treaty, described by President Johnson as "the most important international agreement since the beginning of the nuclear age."

I would add that, on the whole, prospects for successful arms control negotiations with the Soviets seem to be improving. Responsible Soviet officials appear at last to have understood that

arms control agreements can be in their net interest. Moreover, while Soviet expertise in this field has appeared to lag somewhat behind our own, there are a number of Soviet officials and scientists who have a sophisticated understanding of the subject.

Undoubtedly, we will continue to have plenty of troubles with the Soviet Union, but I do not believe these should be permitted to interrupt our arms control efforts. One of our reactions in the wake of the Soviet invasion of Czechoslovakia is illustrative of this point: It would not have occurred to us to react to this development by canceling a series of defense contracts or calling home units of our NATO forces; and yet we found it appropriate to delay action on ratification of the Non-Proliferation Treaty, although we regard this treaty as aimed, no less than defense measures, at promoting the national security of the United States. I can quite well understand, in political terms, the reasons for our action. But I feel that in the future we must strive to prevent extraneous factors—however important they may be in their own right—from interrupting the basic quest for national security and well-being.

Special Treatment for Arms Control Negotiations

To the extent that arms control endeavors are regarded as just one more facet of diplomacy, like trade or cultural exchange agreements, there will be pressures to turn them on or off. The prospects for their success would be greatly enhanced if they came to be regarded as an essentially apolitical undertaking, to be pursued in good times and bad.

Do arms control endeavors really rate such a "privileged status?" I believe strongly that they do, not only because of the relatively short-term benefits, referred to earlier, in security and well-being, but also because of the long-range political benefits which arms control can be expected to engender.

Efforts to bring about systemic changes in the way the world is organized—such as establishing a world government—have proven to be utopian, for they have failed to take into account such obvious obstacles as national interests and the ambitions of political leaders. Arms control agreements, on the other hand, are partial measures which have already demonstrated a substantial degree of feasibility and acceptability. The gradual extension of a network of arms control agreements, not just between the United States and the Soviet Union but across the world, is not an impractical vision. The Non-Proliferation Treaty is already an appreciable step in this direction. To promote and sustain such a process, we would have to depend largely on self-interest as a motivating

force; but in the operation of the existing arms control agreements we have already seen evidence that this can be made to work.

Pragmatic Approach

Of course we must not fall into the utopian error of expecting too much from such an undertaking. It would not solve all the world's problems. But it would serve to place a series of additional restraints on the international community, thus setting the stage for further measures to bring about a more rational ordering of international life.

Mankind, in the face of crisis, has many times risen to great heights of wisdom. As the realities of the age in which we live become more widely understood, I sincerely hope and believe that wisdom will again prevail. For what confronts us is a prospect, on the one hand, of potential dangers that defy our imagination, but on the other hand, of unprecedented opportunity.

With his resignation on December 31, 1968, The Honorable William C. Foster completed eight years of service as Director of the U.S. Arms Control and Disarmament Agency. He had previously held distinguished government posts as Under Secretary of Commerce, Deputy Administrator and Administrator of the Economic Cooperation Administration, and Deputy Secretary of Defense; and he has served among the principal executives of the Pressed and Welded Steel Products Company, Inc., the Manufacturing Chemists Association, Inc., Olin Mathieson Chemical Corporation, and United Nuclear Corporation. Mr. Foster studied at M.I.T. with the Class of 1918 and holds honorary degrees from Syracuse, and George Washington, and Rutgers Universities and Kenyon and Bowdoin Colleges.

"One senses that a kind of ability and willingness to innovate is a requisite for the transfer of technology in the private sector. . . Firms with the (power) to innovate soak up advances; those without it find difficulty discovering the relevance of new possibilities." (Photo: the century-old Boston City Hall as city departments moved to the new structure, January, 1968; by Benjamin Litson)



Bringing high technology to urban needs requires a research and development agenda and major funding to support it—and a new view of themselves on the part of cities and industries alike

Mason Haire
Professor of Organizational Psychology
and Management, M.I.T.

Industrial Technology and Urban Affairs

It has become a truism to say that technologies pertinent to major urban problems are available well beyond our current utilization of them. The public is often confused and concerned by the apparent discrepancy between rapid advances in a variety of fields—space, consumer products, high speed data processing, and the like—and archaic solutions to the cities' problems. Even people close to the problem—potential suppliers, city officials, and students of the matter—find the lack of effective penetration of technology bewildering.

One immediately thinks of a variety of possibilities—waste disposal, information systems, housing, and, indeed, a systems view itself. What kind of things account for this strange anomaly—on the one hand a pressing national need, and, on the other, high levels of relevant technology, but a failure of the two to come together?

Recent studies at M.I.T. have been, for many of us, a detailed examination of our own naiveté because the problem is, in many ways, a new one and a product of an unusual collection of events. This report, written by one of the participants in several activities set up in Cambridge to study these issues, does not necessarily represent the views of other participants or of M.I.T. With this introduction let me point to some of the things that seem to stand out as barriers to the penetration of technology in the urban area, and let me add the proviso that the list is by no means exhaustive.

The Marketing Problem

Some of the difficulties we observe in bringing together technology and the cities seem to have the characteristics of straightforward marketing problems. It is very difficult for companies to identify their customer. Companies that sell, for example, sewer tile or fire engines know their customers and know the characteristics of the specifications their customers want. But high technology companies find difficulty in identifying and aggregating the market, and they fear encountering situations that seem to demand prototype, one-of-a-

kind, or software solutions. It must be added immediately that most companies seem to be doing very little in an active way to solve this problem of the identification of the customer. In most cases, for example, the sales force is the regular industrial sales force. When salesmen are brought back to the company for training, the training is on company products and not on customer characteristics. In rare cases companies seem to have tried to develop a whole new posture and a new set of personnel to meet this new market, but this response is very much the exception.

The pluralism of suppliers unfortunately matches the pluralism of customers as a barrier to the adoption of technology. In high technology areas, the supply side of the market equation is equally diverse, disaggregated, and confusing. The industries offering new technology are not visible to cities as suppliers, and cities do not know where to turn. Who, seeking a city health system, would turn to an aerospace firm or a major electrical equipment manufacturer? Yet two such firms are active in the field of urban health. Another major electrical equipment manufacturer is interested in waste disposal; another aircraft firm in rodent control. The suppliers' potential, as well as the market, is disorganized and difficult to deal with.

Unfortunately, a simple organization of the market will probably not solve the problem. For one thing, even if we identified the customer, it isn't clear that he has enough money to buy; it has been said that we can run cities better with the money we have, but we can't run them well with it. The problem clearly calls for a major recommitment of national resources. Considerable case can be made for the argument that, in recent years, high technology industries have developed almost only where the federal government was the major customer. Space and defense are obvious examples. Even numerically controlled machine tools might have remained an intriguing possibility had the Air Force not committed itself to them. If the level of technology in urban affairs is to be raised, a similar kind of

massive and dependable commitment to funds for development and purchase may be necessary.

Simple statements about the size of the market are clearly not going to do the job. We are used to announcements that, for example, the need for waste disposal systems is \$6 billion over the next five years. There seems to be a kind of hope that such astronomical calculations and their public release will have an exhortatory effect. However, there is no reason to believe that general statements of this sort elicit a marketing response. The private sector experiences only frustration from being constantly assured that there is a large market available but being unable to find it. The market must be differentiated, focused, identifiable, and effective in order to attract developmental effort to serve it.

In this situation we need to assure a system that will adapt to the user; we should avoid slipping into a system where the user must adapt to the characteristics of the supplier's products, production techniques, and level of technology in order to make a market. Indeed, one of the problems of the city is exactly that it must adapt to the effects of technological change. Many of the ills of cities grow directly out of suppliers' technologies in various areas. Developments in transportation have dislocated residence and work patterns and have left the cities with capital responsibilities but little tax base to support them. The city's role in socializing underindustrialized segments of the population puts strains on community organization in the form of poverty, police-community relations, education, and the growth of the urban casual labor force. Cities are already reeling from attempts to cope with the by-products of technological advance. If advanced technology is to be useful to the cities, the problems of the city must be prominently stated in the specifications for solution. We cannot afford the inadvertent by-products of solutions that flow mainly from exciting opportunities in products or processes.

Part of what is needed is to state the cities' goals and needs in such a way that technological possibilities can be made relevant to them. It is remarkable how often companies seem to say, "If they will only change in such and such a way, we can help them." There is a standard human tendency for the helper to feel that the first step in the helping relationship is for the helped to change so that he becomes more like the helper—a special variant of the argument that the cause of poverty is the poor. Part of what seems needed is for the potential helper—industrial technology—to come to understand the helped—urban areas—in their present situation and to accept the fact that the helper may have to change in order to make his help effective.

Organizational Difficulties

Another group of problems in establishing the relationship between high technology and urban affairs centers around the differences in organization, climate, and tradition between cities and industry. For example, there are real differences in the attitude toward risk between the two. Companies often will not risk development costs without seeing the market; if they can see a market and a relatively long-term future in which to amortize costs, there is real reward for innovation. City officials, on the other hand, may get more reward for not being wrong than they do for being right. The payoff of broad-gauge, long-range solutions in the city may well exceed the tenure of an incumbent. Companies have time intervals defined by profit and loss statements; cities have time intervals defined by elections. The characteristic of the corporation is continuity; cities' plans, objectives, strategies, and tactics may change overnight with a change of office holder.

These differences mean that the ground from which the two discussants speak is by no means the same. They often speak to different purposes, in different images, and responding to different constraints. This kind of contrast must be explored and recognized in the interaction. It is not at all feasible to ask either to change completely and adopt the other's ways. Companies often complain that cities are unbusinesslike; cities often feel that companies are nothing but businesslike. The two institutions have very different objectives, characteristic methods, pressures, and constraints. What is needed may be more like a rapprochement than a change.

The city often lacks a climate or spirit, very difficult to define, which may well be of crucial importance to the adoption of technology. One senses that a kind of ability and willingness to innovate is a requisite for the transfer of technology in the private sector. There is a tendency for high technology firms to sell to high technology industries. Firms with the ability and willingness to innovate soak up advances; those without it find difficulty discovering the relevance of new possibilities. In a sense, the industry gets the technology it deserves. The same kind of thing is true in the city. Lacking the ability and willingness to innovate, the city does not attract innovative suppliers.

Early steps in the process of developing a willingness to innovate might, for example, involve a change in cities' view of themselves as customers. To a large extent cities now behave as if they primarily bought products. But in many senses the city is, like General Motors, primarily an assembler of other people's products. What the products are or who supplies them are of little concern as long as

"The urban problem is not a cities' problem. It has invaded every aspect of the national agenda and penetrates into the statement of national goals and of the kind of concept we have of our society . . ." (Photo: Benjamin Lifson)



they do the job. A pooling of cities to meet needs might of course gain the leverage of pooled purchasing power; but it might, more importantly, focus a statement of what is demanded and elicit a technological response. In the process, cities might come to see themselves as purveyors of services. The concept of urban utilities, providing for services on a long-term basis in much the way that power utilities presently do, may help to change the cities' concept of themselves as customers, may shift the capital cost, and may change the role of the technological supplier.

One must be careful, in dealing with the combined problems of the market for urban technology, the organization of the city, and the need for federal support, not to overwhelm the problem in its solution. Focusing on an external reward system—e.g., federal money—rather than the approbation and interest of an informed populace is a dangerous course. The effort and investment involved in making the adjective "informed" appropriate is staggering. But, unless municipalities carefully nurture this resource, a kind of sterile centralism or a revolutionary rejection of local government seem likely prospects.

Money and How to Organize It

An important cluster of difficulties centers around the issue of money. It is probably unnecessary to restate many of the hackneyed comparisons that illustrate apparent anomalies in the allocation of federal resources—for example, that we spend four times as much on farm subsidies as we do on the poverty program. Clearly we must have a major recommitment of federal support, both in gross and in detail.

The support needed stretches all the way from funding the construction of a research and development agenda, through funding development costs and demonstration projects, and into the establishment of programs. The size and differential allocation of such an effort is too big a problem to be discussed here.

Present federal grant-in-aid programs may operate, inadvertently, to freeze out innovative technology. The tremendous excess of demand in the cities over the money supply in the grant-in-aid programs means a long waiting time and inadequate amounts per item. Neither of these factors leads to high-technology solutions. Furthermore, no preference

is typically given for innovative remedies. Cities are forced back to patch-and-fit, temporary solutions. Moreover, the specificity of grant-in-aid programs often has the effect of overriding local priorities and leading the city to take advantage of what is possible instead of developing optimal technological solutions.

The problem of funding urban change penetrates every aspect of federal fund management. For example, the current discussion of income maintenance programs has important implications for the locus of the urban problem. Migration to major urban centers has slowed, but it is still a large factor. The cities' role in socializing under-industrialized segments of the population into modern life is the source of one of the major strains. An income maintenance program might well facilitate the growth of staging areas in migration—peripheral smaller towns where the money would go further. Under-industrialized groups might move to the city in stages of residence instead of moving directly in the search for high-paying jobs. This is not at all an argument for an income maintenance program as a solution to urban ills, but only an illustration of the far-reaching fiscal implications of the urban problem. Legislative efforts that are directed, piecemeal, to pollution, housing, or employment, while beneficial, still avoid the essential systems character of the problem. The urban problem is not a cities' problem. It has invaded every aspect of the national agenda and penetrates into the statement of national goals and the kind of concept we have of our society—as well as into such detailed decisions as the devices for collecting and dispersing federal funds.

What can be done about these problems? The enumeration of a differentiated list of difficulties is not at all meant to stagger the reader with the size and complexity of the problem or to suggest the impossibility of its solution. Our first step is to begin to tease out the roots of the issue, and it seems possible to suggest some steps that would be responsive to the difficulties listed here.

The Research and Development Agenda

If one focuses particularly on the penetration of high technology into the urban problem, the primary point is clearly making a market. However, making a market in this case is not simply bringing a buyer and a seller together; it calls for a much more creative undertaking. We need a broad-scale statement of the kinds of things that need to be done on the one hand and the kinds of possibilities that exist on the other hand. We need a research and development agenda that will both set priorities and explore new solutions. We do not need a list of research possibilities of the sort that typically flows from the disciplinary refinements of the

laboratory. These possibilities must be coupled to users' needs. A technology in search of a customer is fruitless in general, doubly so here. The example of companies with what seem to be advanced solutions vainly trying to peddle them through the market of cities is pathetic and dismaying in view of the national need.

The research and development agenda should represent a statement of possibilities that reaches into the future but is still closely coupled to the users' needs. But the agenda should not be overwhelmed by city-specific problems to be solved on a case-by-case basis. We need the generality of technological solutions intermixed with customers' needs, willingness, and ability to pay.

A first step in meeting this need might well be the establishment of an institution whose mission would be to explore and develop such an agenda, and such an institution seems to be a realistic possibility. The Urban Institute has already been established as a quasi-public organization designed for the exploration of cities' problems—a kind of "think tank" in the urban area. A parallel quasi-public organization—an Urban Technology Development Corporation—might have as its mission providing the neutral middle ground between users' needs and the private sector's technological capabilities. Its role would not be simply that of an honest broker; such a corporation should manage that middle ground with a highly creative synthesis. Such an organization is conceivable and possible; and its characteristics have been developed in more detail elsewhere. It may well be that instead of proliferating organizations, this explicit mission should be added to an existing institution like the Urban Institute. Whatever the organizational form of the solution, the responsibility for this overall statement of the research and development agenda is an essential part of the problem.

The cost of such an effort would certainly not be great against the scale either of current expenditures or the size of the problem. It is hard to make realistic guesses about what such an effort would cost at this stage, but in an eventual steady state of development, a research and development agenda program might cost in the neighborhood of \$20 million a year. This would be on the order of 0.02 per cent of the amount spent on urban services, broadly defined. A research and development agenda-setting of this size and a research and development program ten times as large do not seem out of scale with respect to the demands and potential of the problem.

The Role of Universities

Some special roles seem possible for universities in this process. They will, of course, continue to be

Technology and the Solid-Waste Problem

a prominent source for research and development work. In addition, existing university institutions may provide both a neutral ground and a fertile seedbed for the agenda development just mentioned. However, the university's role in the urban scene must certainly move beyond this traditional scholarly function.

A great many universities are moving closer to the urban problem. Some are so caught up in it that the institutions themselves are threatened. The universities' proximity and the pressing nature of the problem combine to suggest a relationship somewhat like that of the land grant colleges to agriculture in an earlier day. The interaction which the county agent provided between the farmer and the laboratory has been a source of fruitful two-way influence and change. This same kind of active interpenetration of the community and the academic institution seems necessary here.

Universities' curricular resources have been very imperfectly mobilized to meet the growing urban interests. Today's generation of students shows an intense desire for a commitment to community programs in the form of both action and study. We in universities now find that we have a remarkable new resource in our students' drive to make a contribution beyond themselves and beyond their narrow self-interests. Universities must find innovative devices to couple their traditional strength with this emerging pattern. For example, future federal support for education may reasonably be coupled with some kind of *quid pro quo* whereby, for instance, a four-year fellowship would carry with it the expectation that the recipient serve two years in an urban post—as a teacher in a disadvantaged neighborhood, an engineer, an accountant, or a social worker, depending upon his training and inclinations.

At the same time, universities might also institute resident, post-experience programs for urban managers of the kind that have been so successfully developed for managers of industrial

organizations in the private sector. Indeed, M.I.T.'s Sloan School of Management introduced such a program in January, 1969, in collaboration with the National League of Cities. The details and rationale of this particular program will be covered elsewhere, but the fact of it is an example of a kind of university resource which could serve to raise the present level of managerial and technological competence in the cities. The existence of even a few hundred alumni of such programs would in a short time modify one of the basic constraints on the penetration of technology which was mentioned before—the development of an ability and willingness to seek innovative solutions.

In sum, the relationship between advanced technology in the private sector and the urgent needs of urban areas is impeded by a set of barriers which arise largely out of the history and traditions of the two institutional groups, out of the market structure of their relationships, and out of the size of the funding that is called for to deal with the problems. The present statement of the problem is not a discouraging counsel of despair; it simply calls for new institutional forms on the part of the federal government and on the part of other institutions in society—universities, businesses, and cities—to meet the particular dimension of the present impasse. Some steps seem possible. Modifications in early steps will be essential. The ultimate solution may be a long way off, but this only emphasizes the need to take the first steps promptly.

Mason Haire directs the program in organization studies at the Sloan School of Management, to which he came from the University of California in 1966. This article is based in part on a summer study session held by M.I.T. in 1968 under a grant from the Department of Housing and Urban Development.

"The solid-wastes future is, then, full of hope, even if there are unresolved problems. We like to believe that we are ready to take whole new attitudes towards the treatment of our wastes."
(Photo: Richard M. Koolish)

...of overriding local priorities and leading the city to take advantage of what is possible instead of developing optimal technological solutions.

The problem of funding urban change permeates every aspect of federal fund management. For example, the current discussion of income maintenance programs has important implications for the focus of the urban problem. Migration to major urban centers has slowed, but it is still a large factor. The cities' role in socializing urbanization

...These possibilities must be coupled to needs. A technology in search of a customer is in general, doubly so late. The example of companies with what seem to be advanced solutions is vainly trying to peddle them through the eyes of cities is pathetic and dismaying in view of the national need.

The research and development agenda should represent a statement of possibilities that reached into the future but is still closely coupled to the urban needs. But the agenda should not be overwhelmed by city-specific problems to be solved on a case-by-case basis. We need the generality of technological solutions intermixed with customers



Solid waste is omnipresent, but vigorous application of technology will render the future more hopeful than the present

Technology and the Solid-Waste Problem

If your city happens to be near an old quarry, clay pit, or the like, you are probably already using it as a dumping ground. So long as you do the dumping in a sanitary manner (discouraging vermin, flies, blowing trash, and pollution of the air or water), you probably won't do better any other way. But most towns and cities have filled up their nearby gravel pits and stone quarries, and difficulties have begun. In contrast to 'town-dump' costs of typically \$3 per ton, a small town might find that the lowest bid for an incinerator meeting air-pollution regulations results in an overall cost of \$20 per ton. And usually there are no alternatives so long as the town elects to handle its solid-wastes problem on its own. On the other hand, a large city usually has a choice of several means of treatment, and may, with skillful control and management, be able as well to use a method which has a mean cost of disposal of \$5 per ton.

Our advice to small towns is obvious: join with others to form a 'solid-wastes district' producing 1,000 to 2,000 tons per day. Then get bids and negotiate (a) not only with companies willing to build incinerators, but with others who would compact the refuse and take it by rail or truck to places where it might be welcome (e.g., strip mines); (b) organizations that would set up separation, reclamation, and composting plants; and perhaps from (c) firms which would build units employing pyrolysis (decomposition by heating in the absence of air).

Bid Pitfalls

We raise a red flag of warning: *Beware* when you come to evaluate the bids and negotiate the fat out of the proposals. It is no job for the amateur. You will need help right from the point of asking for bids, for there must be drawn up very careful specifications and conditions which will apply to all proposals whatever the method of disposal. Absence of such specifications is one reason why many proposals which we had the opportunity to examine arrived at an apparent waste-treatment cost of about \$3 per ton. One can attain this figure

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for most processes fairly easily if one does not include costs of debt service, or of buildings, or power, or labor, or maintenance, and so forth. We found it an almost impossible task to compare several such bids, each of which had omitted large necessary expenditures. An overworked town public works director doesn't usually get so far as receiving several bids, but if he does he soon finds out that he cannot fairly evaluate them.

Some bids were defective beyond the incredible omission of vital expenditures. Some used highly erroneous methods of calculation as the bases of cost figures. One example, which we hope is extreme, was in a proposal made to the City of Boston for a process involving the production of heat as a possible by-product: by equating rate of heat production to kilowatts, the second law of thermodynamics was ignored, and buried in the assumptions were large violations of the first law as well as of the law of conservation of matter. If the errors had not all been in favor of the bidder we would have been tempted to pass them off as the product of poorly supervised proposal writers. In any event, the message for city officials is clear—employ some high-grade assistance throughout the whole procedure of requesting, evaluating, and negotiating proposals.

Knowledgeable Consultants Scarce

Where such high-grade assistance is to come from is not wholly clear. There are few consultants who are knowledgeable in thermodynamics, combustion, and power. Most older-established consultants tend to be designers of incinerators and other plants and are therefore either not available or suspect as suppliers of unbiased counsel concerning work which might involve recommendations of competitors or competing methods of disposal. Until the need is filled, it might be possible for cities to follow some Californian examples where systems-design personnel of aerospace companies were tapped for help at little or no recompense except learning how to analyze certain urban problems. The skills required—but not the

appropriate experience—abound in the systems-analysis and preliminary design departments of large engine and airplane companies.

This solution is not a neat one, and we kept returning to an alternative proposed by another summer study group: there should be set up, or encouraged to be formed in some way, large urban-service corporations which would act in a number of ways for individual towns and cities. Standard specifications for equipment or services could be instituted. Specialists employed by the corporation could undertake much of the procedure of requesting and evaluating proposals. Such corporations might act for a group of towns in negotiations with suppliers of services, such as railroads for bulk hauling of refuse, or manufacturers of large incinerators. Technical evaluations of new equipment could be made and published. Another role of the corporation might be the prototype development of special equipment, for which we saw a large need.

One more form of urban service corporation which seems to be an eventual necessity would contract with a city, or town, or group of towns, to carry out the whole package of solid-wastes collection and disposal. If such an organization could become large enough to effect economies of scale, obvious dangers of monopolistic tendencies would arise requiring some degree of regulation, perhaps going as far as applying rules that regulate public utilities. The industry is a long way from this situation at present. The collection industry is predominantly in the hands of small contractors who are, for the most part, incapable of improving management or introducing venture engineering. Investigations have shown that in certain areas a disturbingly high proportion of the industry is under the direct or indirect control of underworld operations. Maintenance of a high-quality environment (or, for that matter, a service of maximum value) is not something to which these small businessmen devote a large proportion of their energies.

Paper-Sack Containers?

But the suggestion that cities should encourage the growth of large-scale service organizations is obviously of little use to town managers facing immediate problems, however useful such a development might be in the long run. The M.I.T. study made one or two other recommendations of possible immediate usefulness, one in the field of collection and the other in disposal. We made some economic analyses of presently competing methods of collection and concluded that the use of the Scandinavian 'paper-sack' system rather than trash cans would be worth adopting by many communities. Several of our group opposed adding more waste paper in the form of the sacks to

existing mountains of refuse, but these members (I was one) were won over: firstly, by economic studies which showed that additional costs of supplying and then disposing of paper sacks could be just about compensated for by resultant speedier collection; and secondly, by the several advantages (cleanliness, convenience, lack of attraction to flies or vermin) which came as a bonus. We also have in mind some developments in automation of pickup—or at least in a greater degree of mechanical handling—which would further increase the attractiveness of the paper-sack system or similar developments. We were strongly influenced by the practical experience of one of our members who had experimented with several collection systems in his business. He was able to confirm our preliminary cost predictions and supply others.

Landfill for Highways

Another recommendation was somewhat tentative, principally because of its social and political implications. It was made by a member of our study group who has had long experience as a designer of, among other civil engineering work, interstate highways. He suggested the use of the 100-foot borders of these highways for controlled landfill wherever these borders were substantially below the level of the highway. Borders would be stripped in sections, brought up to road level (probably with pre-compacted-and-baled refuse), covered, and planted again. Off-the-road accidents would be made less severe by this step. Probably the suspicion and possibly opposition of conservationists would have to be overcome, but as the overall result would likely be a gain in conservation (since the refuse might otherwise be taken to a marsh, for instance) there should be a good chance that a well-managed pilot program would win over the critics.

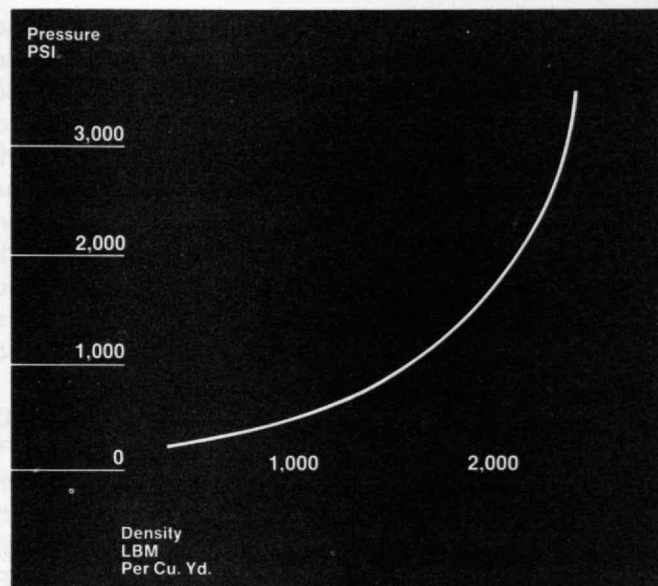
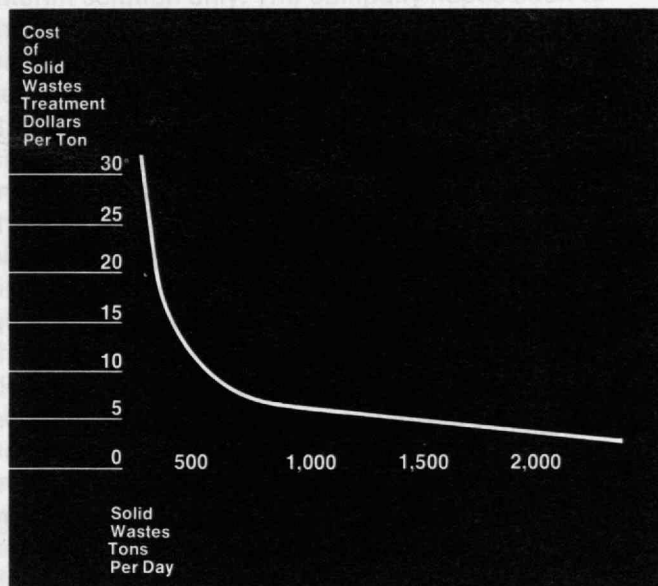
Let me now turn to some longer-range ideas for new procedures or for research or development programs. These suggestions resulted from discussions with knowledgeable people in each field or from our own visits to plants and process operations and other cities. Although there is nothing truly revolutionary which we foresee in the immediate future, such as the type of waste-product recycling which is under development for spacecraft, we anticipate a large variety of minor developments to come and which, when added together, will amount to a virtual revolution. I shall present these developments under three headings: handling and transportation; disposal; and reuse.

Handling and Transportation

To a large extent, the solid-wastes problem is one of handling and transportation, for it is in that area that the bulk of the money is spent. Expense of

The advantages of mass production apply to solid wastes just as to automobiles: as the amount of solid wastes handled by one installation increases, the treatment cost per unit weight decreases. To capitalize upon this advantage, the author urges the formation of urban service corporations to contract for solid wastes collection in a group of towns and cities.

The leverage of technology in solid wastes disposal: compressed at over 2,000 pounds per square inch, solid waste will tip the scales at 80 pounds per cubic foot; and the yearly refuse of 200 million people in the U.S. would occupy a cube less than one-third of a mile on a side.



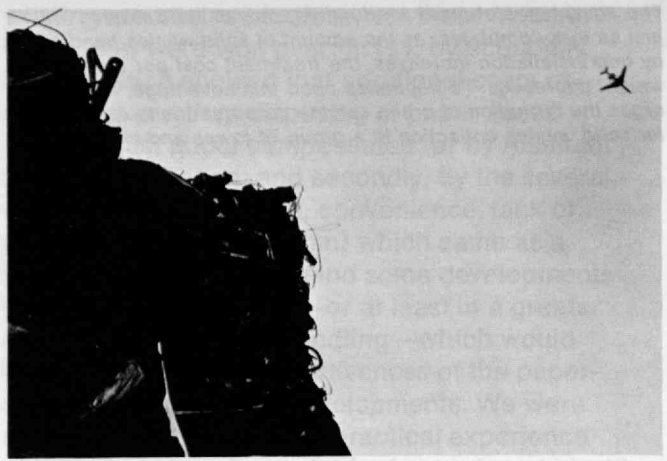
handling often precludes a choice of alternatives which even today invite adoption when we look at our overflowing dumps. For instance, most physical material comes out of the ground in the first place, and we leave hideous gashes and holes behind where we have mined. What better solution than to put wastes back in the same places? Several railroads and some large trucking concerns are proposing this type of solution. To lessen the cost of transportation and handling, they have designed systems which involve so-called 'transfer stations' on rail lines or near highways at suitable sites within towns. Municipal collection trucks would bring their loads to, and dump them at, these transfer stations. There, the refuse would be subjected to various degrees of compaction—the Penn Central Railroad suggests Lombard-designed presses to produce almost 80 pounds per cubic foot at over 2,000 p.s.i.—and wrapped in polyethylene or put in containers before being transferred to trains for shipment. One group (Eastern Land Reclamation) has been negotiating an on-again off-again contract with the city of Philadelphia for this type of arrangement.

When shipment on this large scale is suggested, a

remarkable shrinkage occurs in the whole trash-disposal problem. To the receiving community (never enthusiastic about being the dumping ground of other people's trash), Penn Central has been emphasizing the value of converting an unsightly clay pit, for instance, to a golf course. Sponsors of the idea found, however, that it would take 300 years in some cases to fill just one site with trash from a large metropolitan area! An observant mathematician pointed out that at 10 pounds per head per day and at 80 pounds per cubic foot, the yearly refuse of the 200 million people of the U.S. would occupy a cube of only 2,000 feet to the side. So in the national view there can be no shortage of disposal sites. Transportation and handling can provide one key to a solution.

Bulk haulage would be an easier solution if costs were more reasonably divided between the first stage of transportation—from home or factory to the dump, incinerator, or transfer station—and the second. For while city governments and citizens have balked at solutions which cost \$10 per ton for 'treatment,' they regularly (but sometimes unwittingly) pay \$15 to \$20 per ton for collection. We would like to see more attention given to improve-

"The time appears to be at hand for this nation to harness its resources for a full-scale attack on the increasingly disturbing problem of waste disposal." (Photo: Benjamin Litson)



ments in handling, and especially in the automation of handling.

The extreme in automated handling may be the various underground tube systems, hydraulic and pneumatic, already being used with success in Europe for new apartment complexes and similar developments. These apparently desirable solutions do not make economic sense, however, for existing towns. We favor simply a further mechanization of the present collection trucks, with possibly one-man operation (if the very powerful unions in some areas can be persuaded to go along) of a vehicle which would empty standard containers, and clean the street at the same time, including perhaps operation over and under parked cars. 'Standard containers' might be paper sacks or bundles from domestic compactors.

Disposal

When we turn to the category of 'disposal' (and many maintain that we never dispose of refuse—we store it or transform it), we find much activity. Some machines grind up refuse and produce briquettes; others encase trash inside steel or concrete building blocks; and pyrolyzing machines allegedly turn trash into useful gaseous and liquid fuels and charcoal. When we examine such processes, we find that they seem to have some possibility of useful application to certain problems where the economics are particularly favorable, but that their combined contribution to the overall waste-disposal problem will probably not be large.

Incineration, however, always has, and will continue to have, a large part to play. That part is changing. Open-dump burning has already been widely outlawed, and must go completely. Small incinerators, including those for apartment houses and large factories, are generally much too small to be economical and put heavy demands on air-pollution-control equipment. Even most present municipal incinerators are too small, poorly designed and operated, and have no air-cleaning equipment. The discharge is usually only three-

quarters burnt out so that vermin and insects can still breed on what is dumped. The heat is normally unused. But the last two or three years have witnessed widespread introduction of more advanced European methods and designs: automatic grates; automatic ash-collection; better control of combustion; a degree of burnout which yields an ash useful for road making; and heat recovery. A contract has recently been signed for the first incinerator in the U.S.A. to use an electrostatic air cleaner.

The situation is not all healthy, however. Only the large steam boiler-makers among incinerator designers in this country employ any research staff, and there is the strong possibility that these manufacturers will pull out of the incinerator business because of the small profits to be made. Problems resulting from the combustion of chlorine-containing plastics (HCl is formed, tubes corrode, and nearby vegetation—and people!—suffer) are plaguing the industry in Europe and here. There is little sign of fresh approaches, with the notable exception of the American Design and Development Corporation of Whitman, Mass., which has made an experimental blast-furnace type of incinerator able to produce just a molten slag from almost anything except firebrick.

In order to fill in some of the missing information with the hard data needed if designers may more confidently design tomorrow's incinerators, we have proposed a wide range of programs of examination of various parameters of combustion and of different combustion systems. We have also suggested some studies of pyrolysis, which seems to be at least potentially a good solution for waste lumber and may have wider application. Data presently known about pyrolysis seem either to be commercial secrets or have been taken in laboratories on small and unrepresentative samples of refuse.

Reclamation and Reuse

In our third category, reclamation and reuse, we

see exciting possibilities—exciting because man has always sought to reuse his waste materials—stoves, pottery, metals—almost since he broke nature's cycle of decay and rebirth by using tools. In Europe especially, refuse plants have for many years been designed to distribute the trash on moving belts from which 'pickers,' with responsibility for different commodities, extract better-quality materials. Such operations have become progressively less economic as labor rates have risen. But Metropolitan Waste Conversion Corporation of Wheaton, Ill., has built some plants, the largest of which serves part of the city of Houston, where the employment of 'belt-pickers' is regarded as an interim solution only. The company hopes soon to introduce a machine for automatically removing paper. (Most plants have, of course, used magnetic separation of ferrous materials for many years.) Such a development would have a doubly beneficial effect on the economics of the overall plant—more paper would be separated at lower cost, and the quality of the compost, itself presently in most places only marginally if at all an economic proposition, would be much increased and the quantity reduced. Metropolitan Waste has shown that there are good present markets for compost despite the failures of many earlier plants, and it has put effort into developing new markets and new processes, of which so-called 'hydro-mulching' is the most promising. This process involves spraying a slurry of compost and grass seed—or other ground cover—in water over denuded areas to impart soil-holding qualities.

We have made proposals to the U.S. Office of Solid Wastes—which is sponsoring much excellent activity in this whole area—for the study and development of methods of separating a range of materials from waste. Our most promising concept is to shred the refuse (itself a task requiring considerable development, for most present methods are unreliable or expensive) and to pass it in a current of air along a duct between sensors. The combined readings from several sensors would identify the predominant material in each piece of refuse, which can then be directed into appropriate hoppers by fluidic valves.

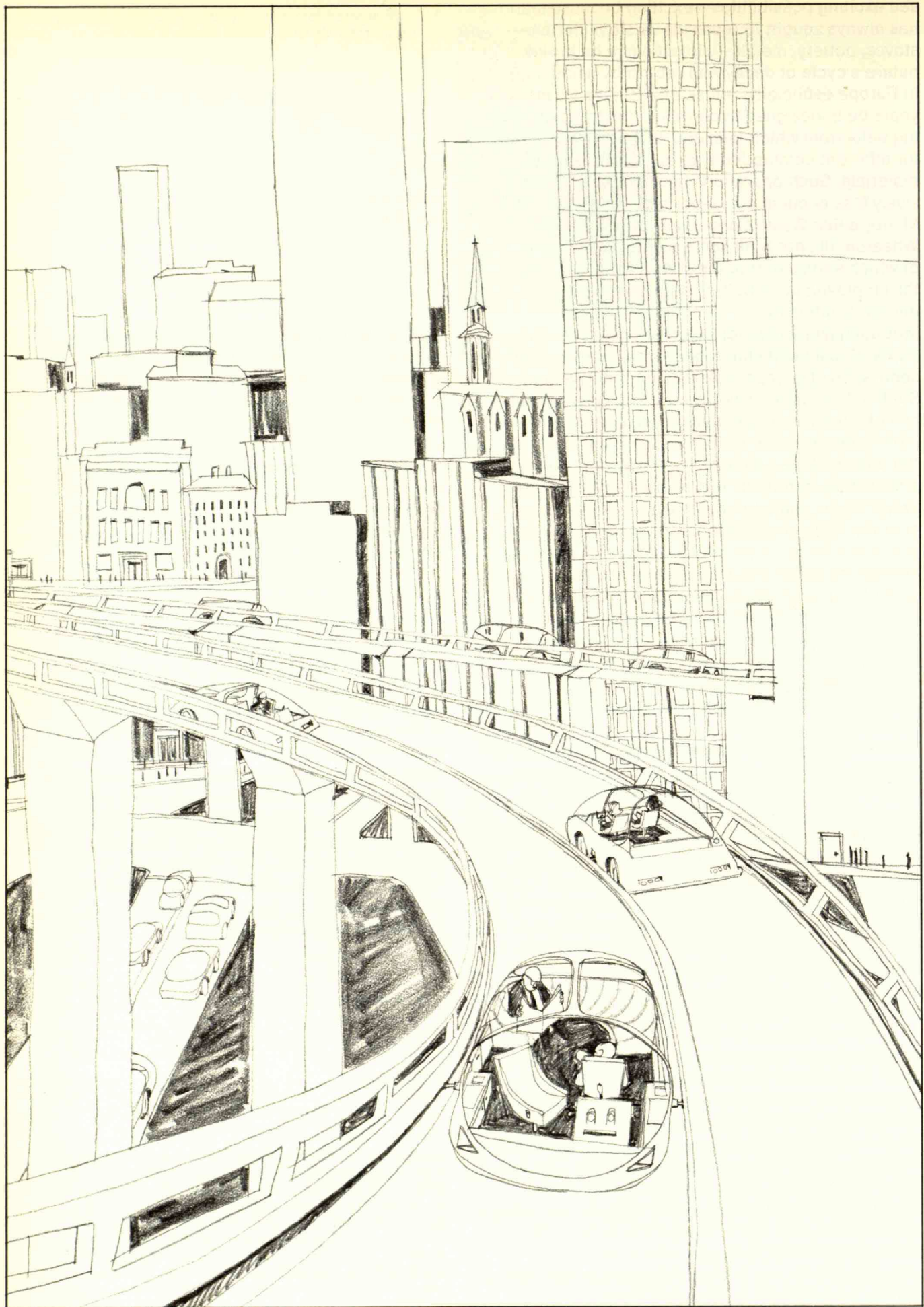
If such a machine were developed, a number of other questions would be raised to which we do not at present have answers. Can the U.S. secondary-materials market absorb much more than the present 100,000 tons per week of waste paper? Our visits to secondary-paper mills would give an affirmative answer. How about iron and steel? Introduction of the basic oxygen furnace has led to a reduction in the use of steel scrap in the U.S., but at present the Japanese, who have virtually no ore of their own, are buying all the scrap they can get (so as to be able to ship cars and tankers

back to the U.S. and elsewhere). The plastics picture is obscure. We found that the big producers of primary plastics have no way of disposing even of their trimmings of thermosets (as distinct from thermoplastic materials) except by burying, in some cases, or burning in those other cases where noxious gases were not produced. We hope that there will be vigorous work devoted to the problems of 'disposing of the disposables' or, preferably, of finding new uses for these increasing components of our throwaway economy.

Decision Time is Now

The solid-wastes future is, then, full of hope, even if there are unresolved problems. We like to believe that we are ready to take whole new attitudes towards the treatment of our wastes. The United States faces some severe problems—not so severe, in this regard, as those faced by other more densely populated countries. We have allowed ourselves to lag behind, however. In many other areas, we have frequently let situations get to the point bordering on a national disgrace, and then have fallen on the problems with unrivaled energy and increasing expertise. The time appears to be at hand for this nation to harness its resources for a full-scale attack on the increasingly disturbing problem of waste disposal.

David G. Wilson led a number of M.I.T. faculty and visiting experts in a 1968 summer study of the management of solid wastes, and this article is a summary of their findings. (The study was supported by M.I.T.'s Sloan Basic Research Fund.) Dr. Wilson is a native of England and a graduate of the Universities of Birmingham and Nottingham; after several years of technical work in the fields of gas turbines and fluid dynamics he became Vice President and Technical Director of the Northern Research and Engineering Corporation in 1961, and he joined the M.I.T. Department of Mechanical Engineering in 1966.



The prospect of an automated highway is so attractive that it promises a new surge of transportation demand comparable only to that generated by the automobile itself

Siegfried M. Breuning
Project TRANSPORT, M.I.T.

Automated Highways: What Is the Dream and How Do We Reach It?

As you approach Boston (or any other metropolis) tomorrow in your daily commuting or from a weekend trip, you will bring your car to a halt to receive acceptance at one of the many approach ramps surrounding the city. There, a small door, flush with the side of your car, will open on a signal from the dashboard, releasing an arm that will engage the car with a rail on the ramp. Another signal will register your destination on a computer. When the access toll has been charged to your credit card, your car will be drawn up the ramp to enter the new guideway system which traverses Boston. Now, with the two vital control factors—speed and direction—automated, you are on your own; you may finish the newspaper, work from your crowded briefcase, watch the sights, catnap At your destination, you will simply step out of your vehicle and leave its storage to the automated system; or perhaps your computerized vehicle automatically shuts off on a decelerating ramp, the arm retracts behind its door, and you drive your automobile off under conventional power.

Between this “utopia” and today’s frustrations lies a complex effort, the barest outline of which appears in the following pages. On the basis of many years of research and planning, we are convinced that better automotive transport is a realizable goal and that it will take the form which this episode suggests.

Our needs clearly include better utilization of whatever area of the earth’s surface is devoted to automobile transportation, highways, and parking alike. We need to increase the efficiency and dependability of our transport. We need to simplify the driving task and at the same time assure that the driver does not become correspondingly more reckless with those tasks he still controls. To reduce pollution, we need to substitute a prime energy source, whose emissions of pollutants can be far better controlled, for many local ones. We need to reduce the skill required for driving, to make it possible for a larger segment of the population to drive well for more of the time.

Automation Concepts

This discussion of current issues in automobile transportation suggests almost self-evidently how automation can alleviate or eliminate the problems. And this in turn leads to two approaches: we can continue the gradual process of automating suitable components of the automobile-road system by devising mechanical devices to assume more and more of the driving tasks susceptible to human error; or we can opt for an entirely new and separate, fully automated, individual transportation system. Somewhere in between is the possibility of converting the existing automobile to a dual-mode vehicle capable of operating as a conventional automobile on existing highways or as a fully automated vehicle needing no driver on a controlled-access, fully automated guideway system. It is such a dual-mode system which is currently under study at Project TRANSPORT of M.I.T.

The Evolution of Automation

From a practical point of view, it is abundantly clear that we are not likely to scrap today’s highway transportation system for an entirely new, unproven alternative, no matter how attractive it may claim to be. Evolutionary procedures are indicated.

The captive-vehicle, closed system is likely to remain for some time a special application for particularly suitable sites such as amusement parks, airports, warehouses, and congested downtown areas. It would make an excellent experiment now, since we still have much to learn about the hardware and software of automated transportation. Eventually, when an extensive guideway system exists, captive vehicles will provide the ultimate of driverless service for people and freight.

For the gradual development of automation, we might expect essentially the process going on now—the addition of automated equipment such as automatic transmissions, speed controls, and headlight dimmers—to continue and to accelerate slightly because of the increasing rate of technological development and the increasing recognition

of the value of vehicle automation. The difficulty with this process lies in integrating the components which are being developed into a meaningful totally automated transportation system. Recent progress suggests that this kind of automation of components for vehicles and for highways comes at an excessively high price and is rarely if ever planned with any foresight for later integration with other improvements.

This leads us into the potential for the dual-mode vehicle. The dual-mode system makes possible the use of existing vehicles with modest modifications, and it makes conceivable a gradual development of the guideway and control equipment based upon these vehicles. The initiation problem is even more simplified by the possible use of automated pallets, designed to accommodate a vehicle or perhaps a cargo module for transportation on the automated section of the trip. At the entrance to the guideway, a vehicle drives onto a pallet, records its destination, pays, and is then automatically whisked to its destination exit.

The next logical transition—a guideway system which will accept both pallets and dual-mode vehicles—combines the advantages of both and suggests the flexibility we believe to be inherent in the dual-mode system. We believe that the time is now appropriate for beginning a long-range plan of research and development which will eventually lead to prototypes, then working pilot systems, and ultimately a standard automated guideway system under the configurations we have suggested above.

The Automated Dual-Mode System

An effective guideway must control vehicle direction and speed in accordance with its destination, and it must supply power for moving the vehicle. The system we believe most promising for speed control and steering utilizes two side rails for positive mechanical guidance and constraint of the vehicle and also for power supply. A retractable arm on the vehicle engages the rail and picks up power and control signals, and the same arm also steers the car, either through mechanical linkage to the steering gear or by developing side forces acting upon the moving car.

Other means for steering have been proposed, among them a steel-wheel-on-steel-rail concept for guidance with the rubber wheels used for support. Steering along a buried cable by means of a set of pick-up coils connected to a steering servo-mechanism has been proposed for conversion of existing roadways to automated guidance. Another notable concept is a vehicle straddling a beam with its wheels cambered inward to engage the two sides of the beam. On conventional roads the wheels return to the normal vertical position.

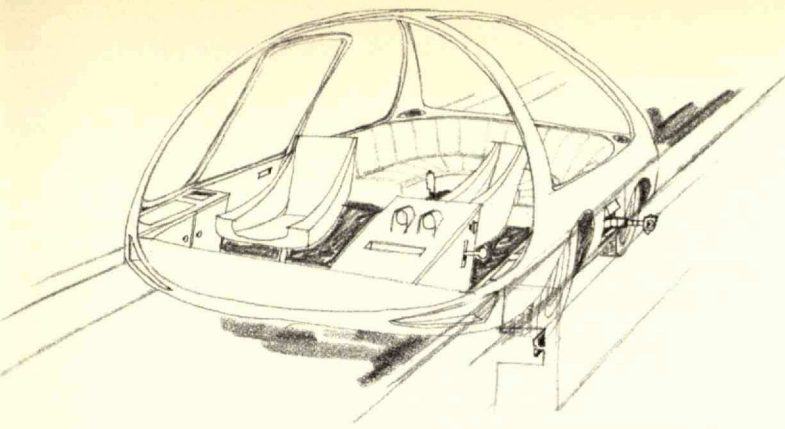
Speed control also can be achieved by many means and the final choice must be based on further experimentation. Conventional speedometers probably cannot be made sufficiently accurate to ascertain proper headway distances on the guideway. Some schemes do in fact propose to allow some small speed differential between successive cars with the expectation that gaps between vehicles will open and close and successive vehicles may in fact occasionally bump. Other proposals for maintaining headways depend on headway detection devices, either between successive cars or along the guideway rail. If precise speed or position control is desired on the guideway, different nonconventional speed and position measurements are necessary, such as a time-related counting and feedback device in the car which measures the rate at which the vehicle passes a series of identifiable points on the guideway, adjusting speed accordingly. A compromise between these concepts might utilize a fairly accurate speedometer with a correction system built into the guideway at given block intervals so that between successive blocks the speeds of the vehicles would be adjusted and an overall average headway maintained.

Guideway Configuration and Construction

Irrespective of what control system is eventually adopted, all cars on the guideway will travel, for all practical purposes, at constant speed and therefore with fixed headways. Thus it will be possible to operate vehicles at much smaller headways than on conventional roads. As a result, we expect at least a fourfold increase in lane capacity over that of a conventional highway. In addition, the reduced width required for the guideway will result in savings in required real estate. Since all traffic will move at constant speed, curves on the guideway can be superelevated to exactly balance the centrifugal force. The larger superelevations will make possible sharper turns and further economies of real estate. Since the guideway structure more closely resembles a railroad than a highway, and can probably be mass-produced and prefabricated, the guideway is likely to be less expensive than a lane of expressway. All these factors combine to make the economics of the guideway for a given traffic capacity very attractive indeed.

Automated System Control and Management

Entrances and exits to the guideway, interchanges, and stations present a more difficult problem. At an entrance, vehicles not acceptable to the guideway must be positively identified and rejected. Acceptable vehicles must then be accelerated and entered into the traffic stream, after it has been determined that the system is not overloaded, not only at the entrance but also at later links over which vehicles will travel. The system's capacity must not be exceeded at any point. Thus, control devices will



remove congestion from the guideway system by confining it to its entry point, just as we now propose to meter traffic on expressway ramps.

System control can take many forms. There is a clear trade-off among methods for locating the control apparatus: in the vehicle, on the roadside, or in a central system computer. Undoubtedly the final solution will involve some control equipment in the vehicle and some in a centralized computer, but the best mix has yet to be determined. The centralized computer will likely provide routing, maintain capacity checks on all guideway links, and provide centralized accounting and billing. For each of these processes, various algorithms can be used, depending upon the ultimate objectives of the system.

Stations along the guideway will be necessary to allow vehicles to leave the through-traffic flow and load or unload passengers or cargo. These stations may or may not have associated parking facilities. Since it is possible to run vehicles without drivers on the guideway, it will be possible to provide automated parking facilities in low-cost areas to which empty cars are sent after drivers have left them. But since recall of individual cars from outlying garages will be time-consuming, it is likely that the guideway will foster increased use of rental cars, some of which would be stored bumper-to-bumper on a station lane. Such cars could be used on an overnight basis—rented in the evening for the trip home, stored overnight in the driver's garage, and released into the rental pool the next morning upon his return to his guideway destination.

While the guideway looks very attractive as an economical substitute for heavy-traffic arteries, its ultimate value comes with a fairly complete guideway network, extending even into low-density suburban areas for fully automated passenger and freight service to the individual home. This suggests that guideways may replace streets in new neighborhoods, if prefabricated, standardized, grade-separated guideways can be provided at very low cost.

Problems of Implementation

Some of the biggest problems of developing an automated guideway system are legal and financial. Although clarification may be required of the relation to a new system of many of the existing laws regarding transportation, so far there seem to be no insurmountable problems.

Concerning the question of financing, however, the situation is quite different. Support for research and development in the amounts necessary for meaningful and comprehensive work is lacking. Industry is loath to spend huge sums for risk development in the face of the real possibility that government may step in and support at least the research phase, or that in the end the government may prevent a single developer from reaping the payoff on his risk development if it proves very attractive to the public.

There are also questions of ownership—of vehicles as well as guideways. The restrictive nature of the guideway and the stringent quality requirements for vehicles that will wish to use it seem to suggest private or quasi-private ownership and operation. Governments, either local or state, are not traditionally known to move into innovations such as this one very rapidly, although highway departments or transportation agencies may find this a promising alternative that will ease their ever-growing burdens.

An Approach to Implementation

Enough understanding is now available about automated transportation to move forward actively into areas in which more specific knowledge must be obtained. Most theoretical questions have been amply discussed. It is time to initiate experiments that will advance the understanding of both the hardware and software.

Our first need is for a prototype technical experiment of real automated vehicles on real guideways capable of continuous operation in a controlled environment. Guideway and dual-mode vehicle components necessary for automated operation

This chart shows the alternatives which confront engineers and planners contemplating the potentials of automated vehicles and guideways. It demonstrates clearly that the choices are not simple and no alternatives are ideal.

Type of Vehicle	Operation on Existing Road	Action at Guideway Entry Point	Driver Action on Guideway	Vehicle Disposal at Passenger Destination, if on Guideway	Action at Exit Point	Vehicle Disposal at Passenger Destination, if off Guideway	Advantages
present auto	manual	car driven onto pallet	give destination; pallet moves automatically	vehicle must be stored or re-routed	car leaves pallet under manual drive	park	immediate use of guideway by auto or other containers without costly modifications
guideway pallet	not possible				not possible	not possible	
dual mode auto individually owned	manual	check for acceptability	give destination; vehicle moves automatically	"	transfer to manual operation	park	personalized with elimination of driving strain on guideway
dual mode auto rented from system	"	"	"	vehicle must be re-routed, stored, or re-rented	"	park or return to agency	easy storage (bumper to bumper stacked, moving empty)
vehicle for automated operation only	not possible	passenger enters vehicle at guideway station	"	"	not possible	not possible	cheap vehicle, no driver needed—great for freight

must be designed, constructed, and fully tested for operational suitability and reliability. The test should also provide clarification of the rather complex control requirements of an automated system, and it should also give some preliminary indications of public reaction.

At the next stage of research and development we will need experiments focusing on the system in continuous operation, and thereafter we will need a pilot system study, exposing the concept to public use and acceptance on a limited scale under controlled conditions.

In parallel with this experimentation, and no less important, is the need to clarify the system *framework* in which an automated dual-mode transportation system can begin to function effectively. A multitude of hardware and software alternatives must be reconsidered and updated at frequent intervals, so that alternatives will be available in case an initial design turns out to be unfeasible or

shows signs of obsolescence. If we could not at that time switch quickly and efficiently to an alternative system, we would eventually be saddled with a highly inefficient system.

We must also at this stage develop the legal framework within which automated transportation can function effectively, and we will need to design an effective administrative structure for the development and operation of the new transportation system.

In all this, we must recognize the possibility that automated transportation will attract a larger demand for transportation from those who will drive more because driving is more pleasant and also from that half of our population who cannot now drive. For not least among our aspirations for an improved system is the provision of transportation for millions who do not now drive. They include, particularly, two underserved groups—the poor who cannot now afford cars and the physically

handicapped, young and old, who are unable to drive conventional cars. Indeed, we think it entirely conceivable that transportation demand will actually double, perhaps triple, over its current level. People like individualized transportation now and they will like it even more if it can be improved. We must be prepared to meet such potentially drastic changes in demand.

The research must be designed to allow maximum flexibility, both in timing of experiments and in choice among alternatives. Progress in developing automated transportation must always be responsive to the changing needs and tastes of the individual and his society.

Expectations and Recommendations

Further research and development will provide clearer answers to questions related to automated guideway transportation. For the present, we at M.I.T. aim our planning at ultimately providing access even to low-density areas, but we cannot predict when this can be done. Of course, a system that connects all points has substantial advantages. It offers mobility for nondrivers, and it encourages driverless trips and automated travel within neighborhoods. Automated access to individual homes may become a reality much sooner than we now foresee if the public wholeheartedly embraces automatic transportation.

The sum of the implications of automated transportation is a long list of potential improvements: congestion will be minimized and removed from the system's access points; safety will be improved through reducing sources of human error; storage problems will be alleviated since vehicles can be automatically routed to and from automated garages in remote areas; smog will be reduced; and nondrivers will be accommodated on all automated routes. Travel will become substantially more enjoyable and attractive.

Three major tasks are before us now, to prepare for realizing these benefits: we must work out an

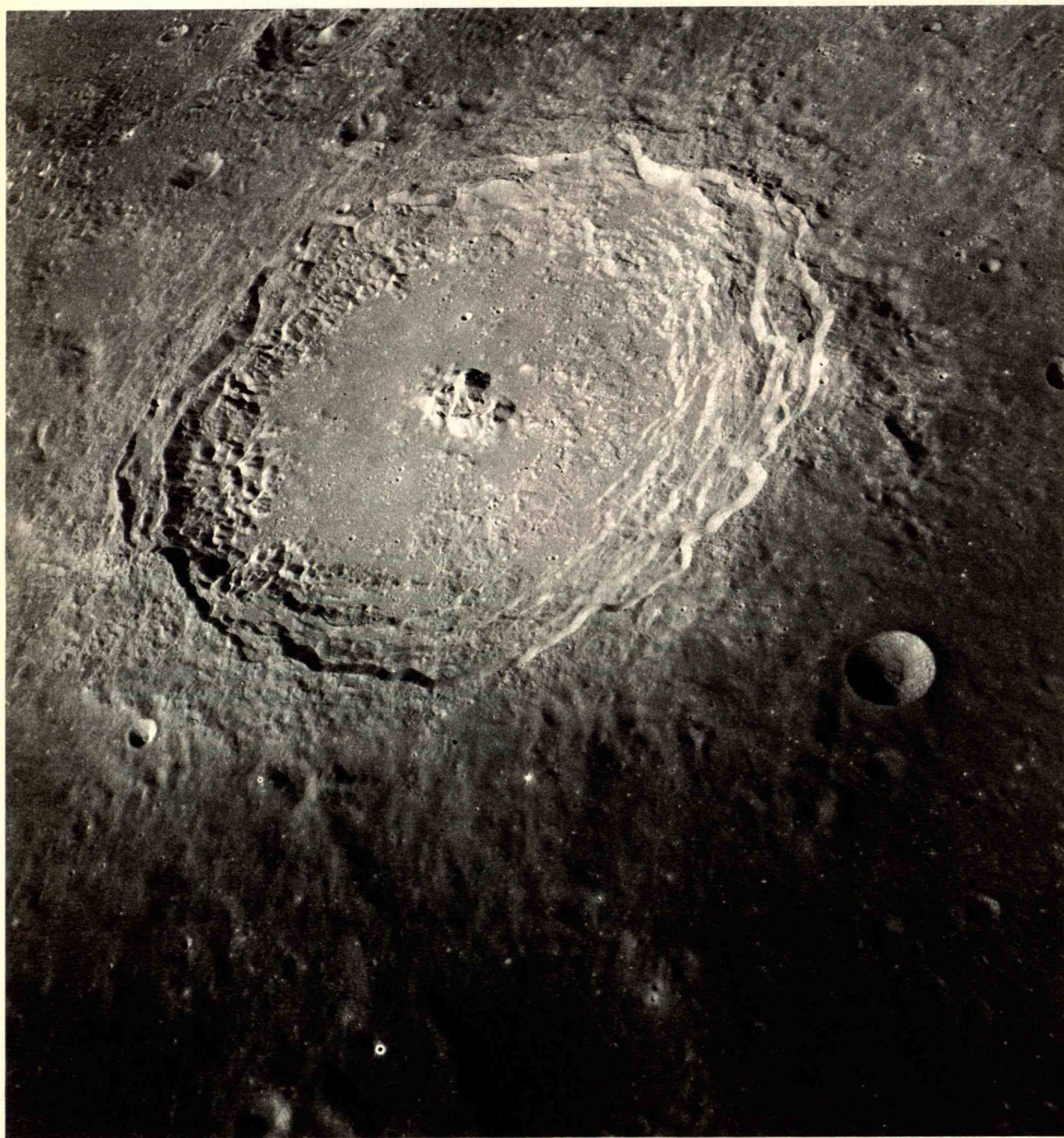
orderly program for research and development on automated transportation; we must prepare for the possibility of avalanching demand; and we must predict and plan for what will happen to individuals, society, and the economy when confronted with another transportation improvement as startling as that effected by the automobile at the turn of the century.

Siegfried M. Breuning is associated with M.I.T.'s interdisciplinary study of transportation problems known as Project TRANSPORT; he holds a doctorate in civil engineering from M.I.T. (1957).

This article is based on work done by many individuals at M.I.T. over a period of years, supported by grants and contracts from governmental and industrial sources—notably, among the latter, the General Motors Corporation. Earlier publications on specific problems have included the following: On dual-made vehicle design—"Commucar—An Interurban Transportation System," by Dwight M. B. Baumann, Robert W. Mann, and Ernesto Blanco, Technology Review, July, 1964. On the concept of automated pallets—"Quadramode Transport: A Class of Controlled Systems," by David G. Wilson, E. Farnsworth Bisbee, John Clarkson, and Igor Paul, Project TRANSPORT, August, 1968. On man-machine control transfer problems—"Big Brother as Driver," by Thomas B. Sheridan, Human Factors Society, October, 1968. On relevant technical details and systems—"Tire Measurements in an Automated Automobile-Inspection System for Turnpike Entrances," by Michael Deutsch (S.B. thesis in mechanical engineering, August, 1967), and "Merging in Automated Transportation Systems," by Michael B. Godfrey (Sc.D. thesis in mechanical engineering, June, 1968). On transportation demand—"The Car Is Here to Stay: Emerging Patterns of Urban Transport," by Alexander Ganz, Technology Review, January, 1969, and "Urban Population, Households and Housing: Post-War Characteristics and Growth; Perspectives to 1985," by Irving R. Silver, Project TRANSPORT report 68-2, February, 1968. On transportation policy—"Decision-Making and Transportation Policy: A Comparative Analysis," by Frank C. Colcord, Jr., The Southwestern Social Science Quarterly, December, 1967, and "Investing in the Future of Transportation," by William W. Seifert, Siegfried M. Breuning, and Anthony Kettaneh, Harvard Business Review, July-August, 1968.

Many of the initial concepts were developed in two interdisciplinary student projects, the reports of which have been published by The M.I.T. Press: "Project METRAN: An Integrated, Evolutionary Transportation System for Urban Areas" (1966), and "Project ROMULUS: An Adaptable High-Density Urban Prototype" (1968).

The terraced crater Langrenus, which is about 85 miles across, photographed on Christmas Eve from an altitude of about 150 miles.



Apollo 8 was a convincing example of highly effective teamwork between man and machine. Such data management partnerships can give us new control over the earth's resources

Robert C. Duncan
Chairman of the Management Committee
for Science and Technology
Polaroid Corporation

Man, Machine, and Information in Flight Systems

It was with wonderment and praise that the world viewed the instrument panel of Apollo 8 (courtesy of exploring astronauts Borman, Lovell, and Anders). The apparent maze of switches, dials, buttons, and counters overwhelm the untrained observer; but to the pilot, they are keys to understanding the machine which he directs and to mastering the environment. The displays and controls of supersonic transports and other advanced aircraft are not far different in appearance or complexity from that of the Apollo spacecraft.

The instrument panel is part of the *information management* system of the spacecraft or aircraft. The display system is the primary means for integrating the pilot and the spacecraft into a single powerful unit. In Apollo, it is the facade for a huge data-gathering network and data-processing system that encompasses a dozen tracking stations around the world, many Navy ships, five powerful I.B.M. 360 computers in the mission control center in Houston, and fifty consoles of active flight controllers and support personnel in Houston (each backed by dozens of separate rooms with other computers and display consoles in Houston, at Cape Kennedy, and in laboratories at the M.I.T. Instrumentation Laboratory in Cambridge, at North American Rockwell in Downey, California, and at Grumman Aircraft and Engineering Corporation on Long Island.

The energies of these thousands of people and output of these computers are focused toward providing the astronaut in command with concise and accurate data on the status of his spacecraft and subsystems and giving him directions on required changes in velocity, position, and attitude. The information must be condensed and presented in understandable and usable form.

What we see in Apollo is a partnership of man and machine, each partner performing those tasks for which he—or it—is best fitted. Thus, a human astronaut makes observations of the stars for navigational purposes, and a computer then takes

over to do the complex arithmetic. We shall be returning to this question of which are the natural roles for man and for machine. As a starting point, we shall look at the human side of the deal.

Man's Capabilities

What are man's unique capabilities as a controller of systems? Man has a unique facility for exercising judgment. He can reason inductively and has the ability to draw inferences from isolated elements in one situation and apply them to another. The trained human being has the capacity to analyze problems never before encountered and to make decisions on the basis of general, rather than specific, experience. He is a valuable technical troubleshooter, and he can ensure reliable operation of all equipment on board his spacecraft or aircraft by continuously checking and choosing alternative ways of performing the control tasks. Man can himself perform an almost unlimited diversity of tasks; for example, he can:

correlate many nonrelated observations; readily perform diverse physical tasks in any order—moving from place to place, replacing or repairing a faulty electronic component, controlling a moving vehicle, collecting minerals and plant life, and comparing observations with data previously accumulated; make rapid decisions based on seemingly independent events.

In all this, he offers those essential—if barely definable—qualities of intuition, imagination, and initiative.

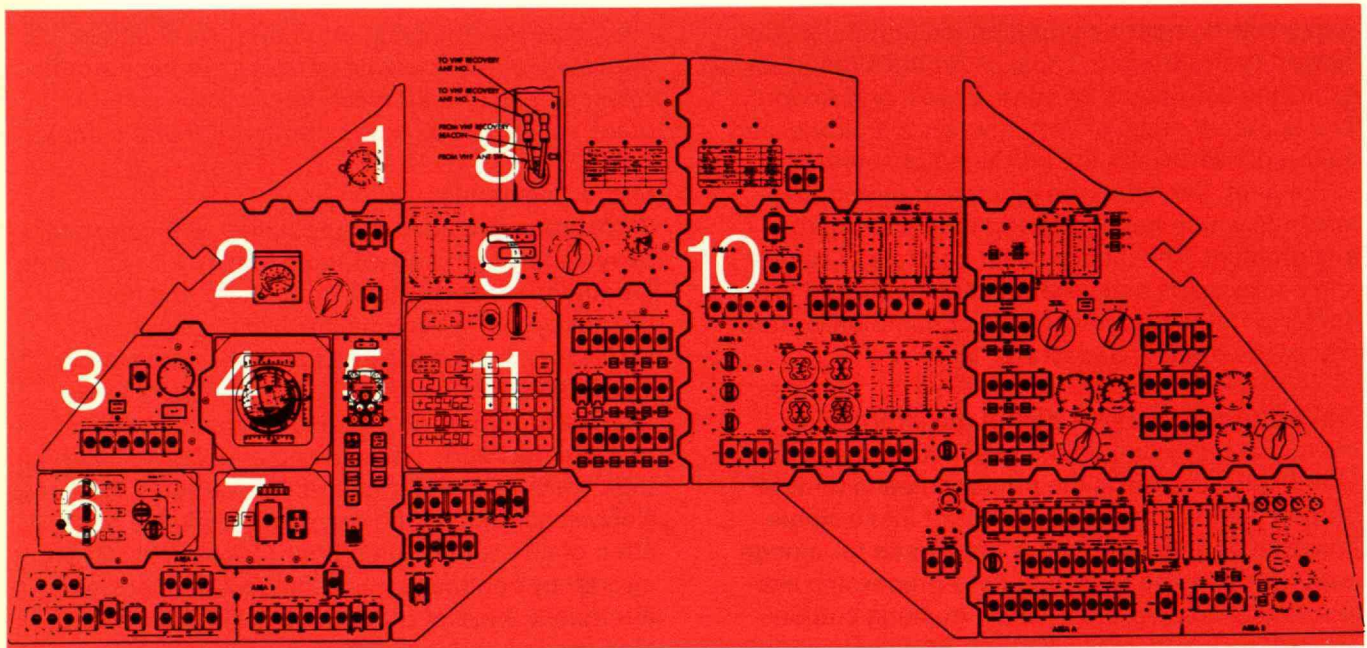
It is interesting to compare some of the debits and credits that result from designing a spacecraft system to include a human crew. The man excels over the machine in the following:

1. detecting tiny changes in visual or auditory stimuli;
2. perceiving, in the midst of noise, meaningful patterns of information;
3. choosing new and possibly highly original

Main display console in the Apollo Command Module.

Some of the more important items are:

1. altimeter
2. switches for flight director attitude indicator (FDAI, or gyro horizon); fore-and-aft accelerometer
3. engine data
4. FDIA
5. launch vehicle status lights
6. attitude
7. ullage
8. VHF antenna controls
9. reaction control system indicators
10. communications
11. computer display and keyboard



courses of action when circumstances change unexpectedly;

4. storing tremendous quantities of data for long periods of time and recalling the required relevant information rapidly.

Engineering liabilities brought on by incorporating man into the system include the following:

1. Much engineering effort is required to make the spacecraft habitable and safe because of the vulnerability of man to the space environment.
2. Engineering provisions beyond a utilitarian minimum must be made for living and rest, because more is required of man than mere survival. Top efficiency performance is a requirement closely coupled with morale and physiological considerations.
3. Equipment required (such as displays, controls, and data-processing facilities to make man effective in his duties) is costly in weight, size, complexity, and dollars.

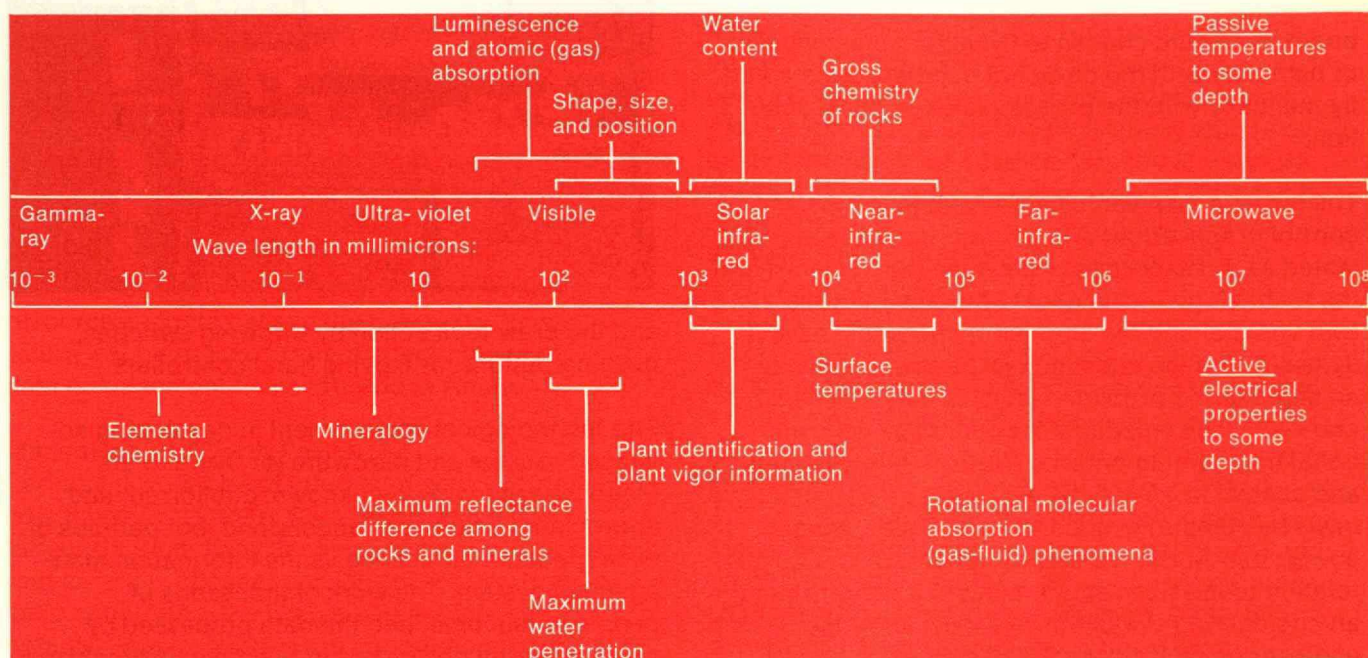
U.S. and Soviet Spacecraft and Spacemen

If the spacecraft shown by the U.S.S.R. at inter-

national exhibits such as Expo 67 are accurate, their display and control panels are simple in comparison with those of the U.S. The Vostok had a small number of switches in one panel to the left of the pilot. In front of the pilot was a small number of dials and an interesting navigation indicator showing the geographic position of the satellite over the earth. In lieu of a gyro horizon, the astronaut had a small window, approximately 8 or 10 inches in diameter, between his feet, through which he could observe the earth.

Medical data released by the Soviet Union and by the United States at various international meetings on the problems of manned space flight have been somewhat contradictory. The Soviet astronauts have apparently had greater physiological difficulty in accommodating to space flight than have the U.S. astronauts. One of the primary differences between Soviet manned spacecraft and U.S. manned spacecraft is that the U.S. astronaut gets more data on the status of his craft. Another significant difference is that the U.S. astronaut has been provided with considerably

Types of information that may be obtained from observations of the earth's surface in various parts of electromagnetic spectrum (from the N.A.S.A. survey "Applications of Biogeochemistry to Mineral Prospecting," N.A.S.A. SP-5056, 1968).



larger windows, giving him a much wider view of the earth. Perhaps these factors have contributed to the easy accommodation of U.S. astronauts to space flight. No flight has been prematurely terminated because of the astronaut's physiological condition or his reaction to space flight (although, on occasion, programs of work have been cut back owing to fatigue). This is not true of the Soviet astronauts. These factors are certainly not inconsequential in designing displays and evaluating the importance of them.

Role of Man and Machine

What is the relative role of man and automated systems in control during an Apollo mission? Man is the primary controller of the vehicle during the terminal phases of rendezvous, during the "transposition and docking" maneuver, and during descent below 1000 feet altitude in the lunar landing. The transposition and docking maneuver is performed soon after injection from Earth orbit toward the Moon—the Command and Service Modules are pulled away from the Saturn IV-B and Lunar Module, and the Command Module is then docked

to the Lunar Module enabling the astronauts to enter the Lunar Module via the docking tunnel. At all other times throughout a nominal lunar mission, the vehicles are controlled automatically. The astronaut monitors the performance of the vehicle and takes over control manually in the event of equipment malfunctions.

The astronaut compares the calculations of redundant computation systems—systems, that is, that should be arriving at the same answer in different ways—and chooses the solution that compares most closely with his own simplified solutions made from charts and nomograms. During Gemini rendezvous, for example the astronaut compared his position as calculated by ground staff with that calculated by his on-board guidance system, and with a simplified solution made from charts prepared prior to the mission. The timings and magnitudes of rocket "burns" were chosen by the astronaut after comparing these three sources of data. During re-entry, as another example, the astronaut had a predetermined nominal trajectory which he compared with the solution derived on

In the Apollo Command Module, below the main console, is the Guidance, Navigation and Control System; the version shown here was under test at M.I.T.'s Instrumentation Laboratories. At the top are the scanning telescope and sextant. On the right is the computer display and keyboard; the computer's fixed memory modules are visible at the bottom of the picture, right. The center panel carries controls needed while making sightings.

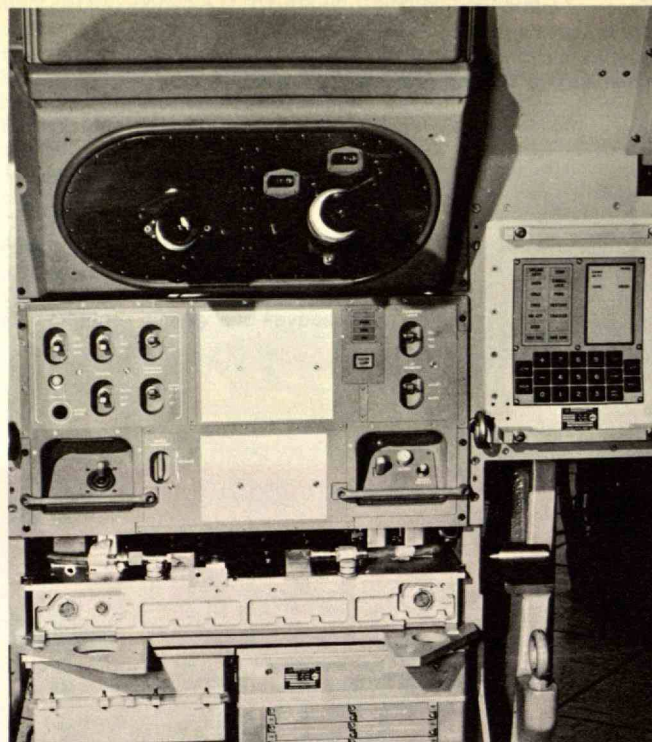
board. He would choose to fly either automatically or manually with the on-board solution, or he could fly manually with the precalculated nominal solution.

The issue of man versus automatic guidance and control in spacecraft and aircraft has often been stated as a disagreement between the humanist and the technologist—the pilot (who likes to fly his own vehicle) and the engineer (who would have it fly itself). But the question can be seen simply as an engineering problem—albeit a very complex one—which is amenable to solution by conventional engineering criteria. Man's role in guidance and control tasks may be evaluated on a technical basis by comparing such factors as size, weight, power, bandwidth, versatility, reliability, and cost in relation to mission requirements. To perform such an engineering evaluation, we must know the engineering characteristics of a man as well as of automatic components.

The appropriate role of man in stabilization, control, and guidance of spacecraft and aircraft is not as a permanent component of any of the normal action patterns, except in specific portions of the missions such as rendezvous or landing. He performs primarily as an off-line parallel or complementary observer. He must be provided with information in a form which he can use. If he can be provided with redundant information from dual sources, and if he is well trained and is carrying with him the proper aids, the pilot can act intelligently so as to improve greatly the reliability and capability of his spacecraft or aircraft guidance and control system.

Information Management

The flight of Apollo 8 to the moon involved obtaining and processing more bits of data than were used by all fighting forces in World War II. It involved a small Navy and Air Force deployed around the world for emergency recovery, and a small army of people on duty to track and control the mission. All the information was provided to the crew by way of the instrument panel or headsets;



and the crew took action by throwing switches, pushing buttons, or moving hand controllers.

The technological achievement in developing advanced rockets and hardware for flying to the Moon is reasonably well known, publicized, and appreciated. Much less understood, but perhaps of even greater significance, is the information management system. The work of thousands of people *in real time*, and the data processed by many powerful computers *in real time*, is organized, processed, filtered, and channeled through one to three people in the cockpit in understandable and digestible form. With this information the pilots can take action with confidence knowing that they are in league with powerful logic systems and an overwhelmingly large number of cells of memory storage.

The use of a few people working together as a team to support flight vehicles started in the late 1930's as the control of air traffic began to evolve. This kind of work received great impetus during World War II as radar was developed and was used by teams of flight controllers, on the ground and in ships, to direct squadrons of fighter aircraft against the enemy. As a matter of fact, this new technique probably swung the balance of power in the air Battle of Britain and in the Pacific war.

The development of high capacity digital computers in the 1950's greatly increased the capabilities of ground control teams. Relatively advanced systems of "command and control"—as the military called it—were developed in the 1960's in all military departments. Perhaps the most sophis-

ticated were the continental air defense network of North America, and the Naval Tactical Data Systems designed to increase the offensive and defensive efficiency of Navy fleet units.

Military reconnaissance systems are relying more and more on advanced data processing techniques with inputs from sensors of many types. The concept of information management using teams of people and high-capacity computers is expanding into non-military areas such as crime fighting in Chicago (see *"Fighting Today's Crime with Yesterday's Technology"* by George A. W. Boehm, Technology Review, Dec. 1968, p. 50).

This technique of combining man with machines, though in its infancy, can solve our air traffic control problems on earth, can help us to explore the planets, or can be used to improve the efficiency with which we develop and use the natural resources of the earth. It is in the latter arena—in improving agricultural efficiency, forestry, and the obtaining of foods and minerals from the land and sea, the "systems management" of our planetary resources—that I believe the greatest ultimate return will be realized from the techniques of data management demonstrated in Apollo.

Management of Earth Resources

Perhaps it would be of interest to amplify briefly how this may be done. Data received simultaneously from many sensors, operating in various (but carefully chosen) portions of the electromagnetic spectrum—the visible and the infrared, notably—can provide more information in real time, when properly correlated, than the sum of the individual bits of data. The sensors can be earth-based or on satellites or aircraft. They provide infrared, visible, and ultraviolet color photography of clouds, sea, vegetation, and land; radiometry data, thermograph pictures, radar measurements, and other kinds of data. Sometimes, large quantities of data obtained by aircraft and satellites can be calibrated by reference to a few selected data points on the ground, on the sea, and under the sea. By combining the data, complete information maps of large area of the globe can be plotted.

The information collected simultaneously by arrays of sensors is far greater than has ever been available to man before. It enables him to predict areas where forest fires are likely, by combining the locations of forests with data on atmospheric lightning, thunderstorms, and moisture at the surface. He can predict areas of good fishing or shrimping by combining information on the temperature, biological content, depth, and salinity of water with the known needs and habits of the various life forms of the sea. He can prevent

devastating famines due to droughts by observing and tracking large scale weather phenomena and planting the right type of grain in years in which the rainfall is expected to be extremely sparse or over plentiful. He can detect deposits of valuable ores in remote land areas and beneath the seas by combining information on topographical features with airborne measurements of magnetic and gravimetric anomalies.

These are simply a few examples of how data derived from satellites and aircraft can be applied to problems on earth. The data is processed, filtered, and presented in usable form to transportation controllers and meteorologists for short-reaction-time uses, to fishermen and farmers for medium-reaction-time uses, and to geologists and other earth scientists for long-reaction-time uses. Ultimately, the rate at which data on earth resources will be managed and processed, continuously and in real time, will dwarf that at the peak periods during an Apollo lunar mission.

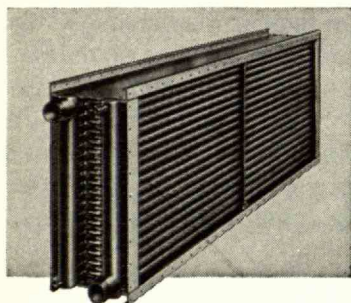
Robert C. Duncan joined the Polaroid Corporation in September after four years with the National Aeronautics and Space Administration planning and supervising studies leading to the development of spacecraft control and navigation systems. In 1967 he received the Hayes Award of the Institute of Navigation. His connection with N.A.S.A. goes back to 1960, when he joined N.A.S.A.'s Research Advisory Committee on Guidance and Control; in the same year he obtained his doctorate in aeronautical engineering from M.I.T. He is the author of Dynamics of Atmospheric Entry (McGraw Hill, 1962).



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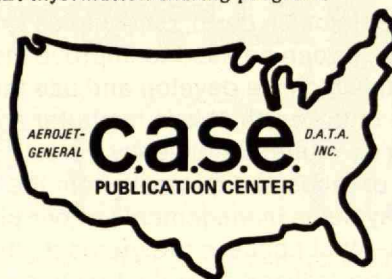
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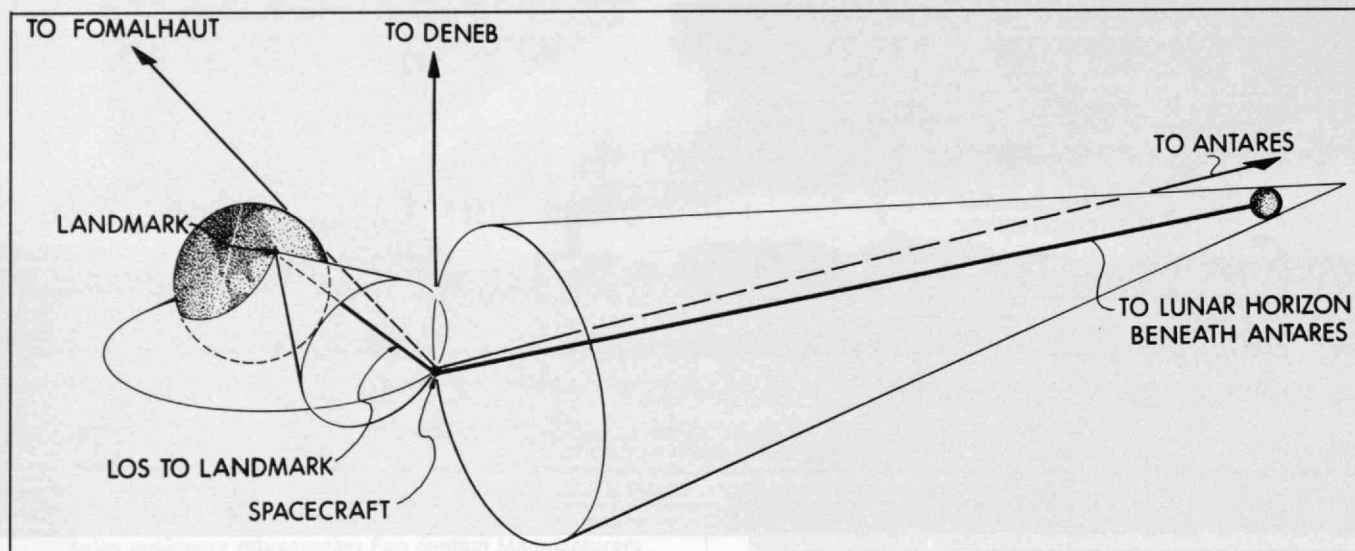
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Trend of Affairs



The Arrival of the Space Pilot

The Apollo 8 orbit of the moon this Christmas marked a turning point in the art of spaceflight. Previous craft could all be classed as guided missiles, relying on earthbound tracking stations to tell their position, heading, and speed. The crew of Apollo 8, in contrast, kept track of their craft at all times, on the basis of their own sextant sightings and the measurements made by their on-board inertial navigation system. The entire guidance and navigation equipment—inertial measurement unit, optics, and a 600-kilobit fixed-memory computer—were designed and developed at M.I.T.'s Instrumentation Laboratory.

The availability of on-board navigation data gave the mission controllers in Houston, Texas, a choice between the traditional and the new: between using the fixes supplied, as always, by ground tracking stations, and using the figures arrived at on the spacecraft. In fact, they chose the former every time. But David G. Hoag, Director of M.I.T.'s Apollo Guidance and Navigation and leader of the Cambridge advice and consultation team during the flight, commented later that it would have made no practical difference which set of figures had been used, so close was their agreement.

Herein lies one unreserved vindication of the M.I.T. work. Another was the truly remarkable piece of ballistics that brought Apollo 8 home. To get back to earth from the lunar orbit required a change in velocity of about 3500 ft./sec., to be done when the ship was out of sight of earth, behind the moon. It was done with such accuracy that only one tiny mid-course correction, of about 5 ft./sec., was needed to hit the re-entry corridor "smack in the middle."

At this point it should perhaps be spelled out that the guidance and navigation system has four fairly distinct functions: navigation and attitude control during the long free-fall periods, and—correspondingly—guidance and thrust-vector control during rocket burns. Asked to pick out one of the four as presenting particular difficulties, Mr. Hoag chose the last. A spacecraft can be an unwieldy thing, with some dynamic properties only partially known (to do with, for example, the sloshing of fuel in the tanks, and the elasticity of its structure). During a burn, the ship is balanced on its rocket motor, and any tendency to keel over must be sensed by the inertial-measurement unit, evaluated by the computer, and corrected by swinging the motor around in its gimbals. In programming this balancing act, one can increase stability only at the expense of precision. Thrust vector control places a heavy work load on the computer (which weighs only 65 pounds) and is itself only an ancillary to the total guidance task of giving

The computer has given entirely new scope to the idea of computation—so much so that men who work with computers have found new ways of thinking, even in areas to which the computer as such may never be applied. The emerging metaphor leads people to think in terms of systems of on-going processes. It is replacing the Newtonian metaphor that tends to provide explanations and understanding in mechanistic terms.

"In fairness to Dr. Wiesner," Professor Weizenbaum said, "I think he was right to question the existence of a gap—in the terms Professor Wilson was using. I believe Dr. Wiesner was talking about the computer as an instrument, and in this mechanistic sense the gap is, as Dr. Wiesner said, simply one widened by technological change. But his basic point is valid. I'll be with him."

Navigation in space: stars provide directions, and the observed angle between a star and a near object places the ship somewhere on a conical locus. A number of such observations fixes the position as the intersection of these loci. In fact, since the ship is moving, a sequence of observations is read into the computer, which extracts both position and velocity. The "near object" can be either a surface feature or a horizon.

The monitoring room at Cambridge as Apollo 8 landed on target in the Pacific. Waving his hand is David Hoag, director of the Guidance and Navigation program and—during the flight—supervisor of monitoring and advice operations at M.I.T.



the ship a particular velocity change in a particular direction. It is in this light that the phenomenally accurate descent-injection burn of the Apollo 8 flight should be seen.

Even the best laid inertial horizon gradually goes adrift, and the need for "a star to steer her by" remains with us—hence the sextant which Captain James Lovell used repeatedly to correct the inertial measurement unit. (Quite often it did not need correcting—the flight was non-typical in that the I.M.U. was left running at all times, rather than being switched off to save power.) The Apollo crewman's job is made easier in that the computer proposes suitable stars and points the sextant in roughly the right direction. The difficult part of the job—compared with that of a seaman—is observing the earth's vague horizon. Somewhere between the cloud-veiled surface and the fringes of the atmosphere, a line must be drawn, and there simply isn't one. Which level of haze to call the edge of the planet is a matter of taste, and there is no reason to suppose that the same spaceman will pick the same

level exactly at different distances and in different light conditions.

Ten days before the flight, therefore, Captain James Lovell, navigator for Apollo 8, visited Cambridge and practiced horizon sightings on a simulator that had been set up using photographs taken from Gemini spacecraft. His level of consistency, says Hoag, was "excellent." During the early stages of the actual flight, one experiment was for Captain Lovell to observe the "horizon" of the earth, to see how well his performance compared with that on the simulator. He chose a slightly lower level than he had in rehearsal, but still very consistently—as his navigation proved.

Sooner or later, space navigators will presumably be looking for edges on the other fuzzy planets—Venus, Jupiter, and on out. And sure enough, Mr. Hoag tells us that M.I.T. has for some time had a few people looking at these planets as navigation targets. True navigation through space, since Apollo 8, is a living skill. The day of the human cannonball is over.

The Computer: How Menacing a Menace?

Does today's computer mark a conceptual break from the cosmology of yesterday—a break comparable to the dash of Aristotelian concepts by Newtonian logic? Is the computer the beginning of a new intellectual technology that contrasts sharply with the old machine technology? Will it drive deeper wedges into the chasm that separates fortunate segments of U.S. society from those shut off from the fruits of newest technology? Will such a cleavage between computer “haves” and “have-nots” engulf societies and nations as well as individuals?

Many notes of this debate were sounded during a three-day Alumni Seminar at M.I.T. last fall. Joseph Weizenbaum, Associate Professor of Electrical Engineering and of Political Science, began the confrontation on the impact of computer-based services on broad patterns of life: “Fortunate, ‘in’ people, with access to computers, will enjoy an elan of life that will be unknown to others,” he predicted. Yet he found grounds to hope that “we will not create a new technological elite that will at once cause a new cleavage in society.”

A similar note came at the same session from Robert M. Fano, Ford Professor of Engineering: “Technology upsets the equilibrium in society by changing the boundary conditions. The changes are triggered by technology but are accepted on the basis of the paths society chooses to follow. Under these conditions, the engineer may not even know what he is doing to society. We must take the services of the computer to the individual to increase his pleasure in living. But while he does this, the engineer must not think of his responsibility to society as an extracurricular activity. He must think of his work in terms of his place as a human being in the society.”

Later, at a panel discussion climaxing the three-day involvement with computers, one of the panelists emphasized the breadth of the gaps he saw driven between access-to-computer and nonaccess-to-computer groups in our future society. “Gaps exist between those whose intellectual circuits are connected to a computer and all others,” said Carroll L. Wilson, Professor of Manage-

ment at M.I.T.—and he cited as an example the growing competitive advantage of organizations using computers widely. The potential of the computer is so great that certain controls may be desirable. “But how do we avoid unwise government control?” he asked. “What machinery might safely be set up for guiding and regulating the computer enterprise?”

Answering the question, the other side of the debate—until now mute before the onslaught of the forecasters of doom—appeared from an unexpected source. Jerome B. Wiesner, M.I.T. Provost, looked down the long table toward Professor Wilson and said, “I’m afraid I don’t know what you’re talking about. What gap? We’ve always had gaps in our society and in our economy. I can see how the computer is a part of a technological gap, but I do not see it as the cause. Maybe some will be better off for using the computer, but I believe it is an exaggeration to suggest that the computer is the cause of any gap. How, for instance, could you convince India that she is separated from the rest of us by a computer gap?”

A reply from Professor Fano, from the floor: “I disagree with Jerry (Wiesner) because the computer deals with information and information pervades everything. If we exclude individuals from access to information, our only out may well be violence.”

Earlier, during his address at the dedication of M.I.T.’s new Information Processing Services Center, Thomas J. Watson, Chairman of International Business Machines Corporation, had said that we should not attribute to the computer more potential than it has. “It’s a tool, an instrument, and we must not downgrade the human mind,” he declared. “The computer has no intellect beyond its storage power. It can never speculate as a human being—that is beyond the computer’s power. The machine,” said Mr. Watson, “has not one whit of morality.”

To this Professor Weizenbaum at a later session responded that “Mr. Watson doesn’t fully understand computation!” Later he amplified this statement for *Technology Review*: “Mr. Watson characterizes the computer as merely a tool. He thus reveals his failure to understand the crucial difference between the imprint of the computer on the one hand and of computation on the other.

"The computer has given entirely new scope to the idea of computation—so much so that men who work with computers have found new ways of thinking, even in areas to which the computer as such may never be applied. The emerging metaphor leads people to think in terms of systems of on-going processes. It is replacing the Newtonian metaphor that tends to provide explanations and understanding in mechanistic terms.

"In fairness to Dr. Wiesner," Professor Weizenbaum said, "I think he was right to question the existence of a gap—in the terms Professor Wilson was using. I believe Dr. Wiesner was talking about the computer as an *instrument*, and in this mechanistic sense the gap is, as Dr. Wiesner said, simply one widened by technological advance. But the widening communication gulf between people who employ fundamentally different strategies of thought, explanation, and understanding is basically caused by the rise of computation. It is not merely part of some more general technological gap."

Overcomplexity?

Three progressions summarize the 25-year history of the computer in our culture, says Joseph C. R. Licklider, Professor of Electrical Engineering at M.I.T.—progressions of capability, scope, and sophistication. Now technology has advanced us on all three fronts so far, he says, that 1969 may be the year of decision: Is the modern digital computer so far along the road to becoming a comprehensive, interactive system that the next generation of machines will be too complex to build and use?

The progression of capability, says Professor Licklider, has seen the speed, memory size, and the capacity per unit cost of computers double every two years for the past quarter century. In the same period—while computer's indexes have gone up by factors of about 1000—the gross national product of most countries has merely doubled. "It is from this overwhelming fact—together with the consideration that what the computer deals with is information, the stuff of which government, business, education, and science are made," says Professor Licklider, "that the computer derives what some see as its vigor and others as its brashness."

The computer's scope has increased, too—through gross data processing applications and now to problems so complex that neither man nor computer can attack them without the other's aid. And the effort to understand computer programming has progressed so well that today "fairly complex and difficult programming tasks are sometimes completed on schedule without great expenditure of manpower and money."

But 1967 and 1968 were to have been the years of transition from the first to the second generation of interactive, multi-access computers—complex machines whose implementation has fallen far behind schedule. The new machines and the concepts for interconnecting them "appear to be near a threshold of over-complexity," according to Professor Licklider.

So 1969 is "a critical time in the history of digital computing": if the second-generation machines turn out to be too complex to operate efficiently there may be a "general retrenchment" to less sophisticated machines and applications. On the other hand, says Professor Licklider, "if they turn out to be within range of timely achievability, we can expect rapid development of many problem-oriented languages and service programs to support on-line problem-solving and decision-making, advances in computer graphics, and major efforts to connect geographically separated multi-access computers into interactive computer networks."

A New Language Barrier

By 1972 there may be as many as 300,000 terminals connected to time-shared computers—but there may also be so much confusion about language that the computers will no longer be understood or able to understand each other. Like travelers unsure of whether to ask questions in English, French, or Spanish, computer users may find themselves "increasingly confused about how to 'speak' with the computer," warn John L. Little of the National Bureau of Standards Computer Center and Calvin N. Mooers, S.M.'48, of Rockford Research Institute, Inc.

Computer systems now benefit from some standardization: magnetic tape comes in specified widths and thicknesses; cards are of standard size; and punched-card encoding is a universal language.

But the nation's community of computer users, the two scientists told a recent Eastern Joint Computer Conference, needs standardized procedures for communicating with the central computer. "User signals to gain access to the system, to delete, and to stop an operation, for example, should be as universally recognized as is the meaning of an octagonal red sign at an intersection," said Messrs. Little and Mooers.

They agree that consensus even now will be impossible. But they urged that standards be established promptly to avoid further proliferation.

Computer Increases University Prestige

Within the next decade the university will supplant the business firm as the predominant influence in the United States socioeconomic structure. The status change will come about because of innovative qualities within the university which enable it to codify theoretical knowledge and couple it with advances in technology for rapid dispersal throughout the social system. The essential reason for this transition will be the computer.

Daniel Bell, Professor of Sociology (International Affairs), Columbia University, told an M.I.T. audience at the 1968 Alumni Seminar on the computer that "the rise of intellectual technology will replace machine technology" as technical and professional personnel "become the fastest growing manpower group in the nation."

Speaking on "The Knowledge and Power Balance in Society," Dr. Bell listed five indices to the character of what he called the "post-industrial society." The new society, he said, will witness these changes:

1. The economy will change to one based on service rather than on industry.
2. The fastest growing manpower group will be men trained technologically and professionally—reaching a total of 15 million by 1975.
3. The university will replace business as the primary institution in the society.
4. The new intellectual technology will replace machine technology.
5. Technological forecasting will make it possible to foretell what the next stage of development will be, providing the basis for self-sustaining growth.

As a result of these changes, Dr. Bell observed that society will become "future oriented" and five-year plans will give place to 20- 30- 40-year plans. He set forth three consequences of these major changes:

1. Conflicts will arise between the new and the old elites, citing as an example a probable struggle between military and scientific elites.

2. Conflicts will arise between men trained in the new intellectual technology versus the politicians.
3. Conflicts will arise between all the values considered important in the total society—choices, for example, between support for improving ghettos or for continuing the space race.

"The principal function of knowledge is to widen the options open for choice by society," Dr. Bell said. "Here is where the new intellectual technology based on advances in the computer comes into play."

Household Word

Computers may be growing more complex (*see above*)—a deepening of their impact on technology—but their proponents also foresee such a broadening of their role as to put computers in every housewife's kitchen and in every child's playroom.

"As we look into the future," says Malcolm M. Jones, Assistant Director of M.I.T.'s Project MAC, "one of the most interesting markets for the multiple-access computer will be its role as a personal assistant to businessmen, scholars, housewives, and even children."

The proposed roles for businessmen and scholars are familiar enough—information retrieval, decision-making, routine control and monitoring, literature search, computation aid. For the housewife, Dr. Jones suggests the computer as bill payer, appointment monitor, meal planner, and bookkeeper. And finally, he proposes, consider the computer for children—a source of amusement for playing games, writing stories and making movies, and a source of learning as a personal tutor.

In these roles for housewives and children, says Dr. Jones, the computer will finally move into the home and achieve acceptance as widespread as the radio, television, and telephone.

"Do Not Fold, Spindle . . .

. . . or mutilate" is not a sign of the power of technology; it's simply a new evidence of man's thoughtlessness, said Anthony G. Oettinger, Director of Harvard's Computation Laboratory, at a science writers' briefing session this fall. Indeed, he said, while in their ultimate development computers may promise to affect men's interrelationships (*see above*), their present significance is largely to make easier the jobs we would do anyway. The problem is simply that computer users sometimes forget to say "please" and "thank you."

For example, said Dr. Oettinger, "computers have not created record-keeping." They have increased the amount of data we can keep track of efficiently, have

made more explicit our use of data, and may in fact have increased privacy by making data unavailable except to those who can use the technology involved.

There is no such thing as "the" computer, a phrase which suggests a monolithic and threatening breed. For there are many computers and many people behind them. The key to the problem, he said, is that these people are relieved neither of opportunity nor responsibility by the computers with which they work.

The Changing Taste of Nutritional Base

Families in the United States have shifted their food habits from crop to meat products—with the big swing to beef, veal, fish and poultry—but their total consumption of fats, proteins, and carbohydrates has shown little change over the past quarter century. "Basically there has been no change in our nutrient base" since 1940, according to David L. Call, who spoke at M.I.T late last fall as Visiting Professor (Cornell) of Food Economics.

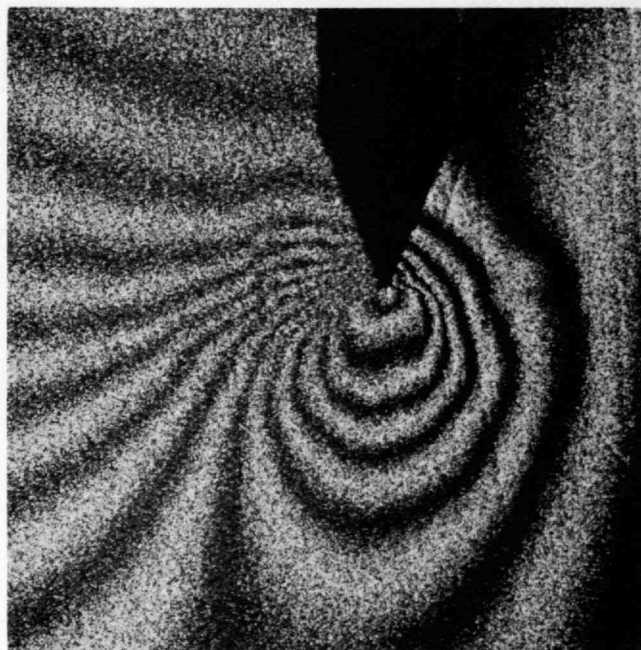
"I want to emphasize that I am using food disappearance as my statistical base," Dr. Call said. "Disappearance refers to all food that has left the retail store without regard for where it goes—to dogs, cats, to waste, whatever. Thus disappearance does not equate with human consumption, and nutritionists who warn us against eating too much fat are using a caveat that does not consider food wastes and uses other than human. In point of fact, my own research convinces me that fat consumption has actually decreased since 1940—the date when disappearance statistics began to be reliable."

Dr. Call noted that a big drop had taken place in the "disappearance" of butter, milk fat, lard, bacon, and salt pork since 1940, accompanied by a pickup in shortening and margarine. "Soybean production is the essential reason for the latter," he reported. "Oils made from soybeans are high quality and inexpensive. We no longer save bacon fat—we use vegetable oils and throw away what is not consumed. Since the 1940's soybean production has jumped from 9 per cent to over 50 per cent of all vegetable fats in the U.S."

Among food products showing increases in the past quarter century, Dr. Call listed poultry, vegetable oils, beef, veal, fish—"pork is in trouble because of its high fat content"—cheese, dry milk, potatoes—"essentially due to processed potatoes for French fries, and other uses"—filled milk products—"with the coconut oil substitution that holds caloric value at about the same level as whole milk"—and margarine.

"Total dairy products have shown an 8 per cent drop from 1948," Dr. Call said. "I am surprised when people say we should eat less butter because we began eating less butter in the 1930's when margarine became popular."

The strain contours in a metal sample which has been pulled apart at the upper left and right of the notch (top) are made visible as interference fringe patterns, light and dark areas, by viewing the metal through its own superimposed holographic image. The width of the notch is 50,000ths of an inch, and the dark areas represent permanent strain contours at intervals of 12 millionths of an inch. (Photo: Bell Telephone Laboratories)



Metal Holography

A surer answer to whether metal will crack under stress is now being obtained through the use of holography—lensless, three-dimensional photography. Bell Telephone Laboratories reports that holographic interferometry, used in fracture mechanics, "permits patterns of permanent strain to be seen 'live' as they spread over the surface of the metal." The procedure "involves making a hologram of the surface of a metal sample before placing the sample under strain. The developed hologram is then positioned and illuminated so that the reconstructed image is viewed as exactly superimposed on the surface of the metal sample. When the sample is loaded, deformations of the surface become readily visible as interference fringe patterns (see accompanying photograph). These fringe patterns show deformation contours at successive elevation differences of half a wavelength (12 millionths of an inch) of the illuminating laser light. Each fringe represents the position of points where the reflected light from the original surface of the sample, as pictured by the hologram, is a half wavelength out of step with light reflected from the now deformed surface."

How Supernovae Persist

Just as a stroke of lightning touches off the rumbling thunder, the violent explosion of a supernova touches off an "optical analogue of thunder" in the interstellar dust—a persisting "optical thunder" that explains why astronomers can see the supernova months after the original explosion.

Thus, the way the light from a supernova behaves really says little about the nature of the explosion itself, just as the acoustical waves of thunder tell little about the nature of lightning, according to recent studies by Philip Morrison, Professor of Physics at M.I.T.

The initial flash of a supernova explosion, Dr. Morrison told a Richmond, Va., audience in November, may last 10 seconds or less.

But as the brief lightning stroke creates a sound wave whose many indirect paths to the listening ear give some duration to the ensuing thunder, the supernova's original explosion sets up an ultraviolet disturbance among interstellar gas atoms. And this reverberating disturbance is manifested as visible light coming to the viewer along many paths.

Dr. Morrison, the first lecturer in the 1968-1969 Distinguished Mathematician-Scientist Lecture Series, a public lecture series sponsored by the Mathematics-Science Center of Richmond Public Schools, pivoted his talk around the intensity vs. time curve observed for supernovae.

Essentially, a supernova is initially seen to have a sharply rising intensity that subsequently dies gradually with time. Such a curve can be drawn from Johannes Kepler's detailed pre-telescope account of the last supernova seen to explode in our galaxy—in 1604—said Dr. Morrison.

And the curve derived from Kepler's unaided-eye data beautifully fits the curves based on the instrument data obtained from modern telescopic observations of supernovae in distant galaxies.

The crab nebula, which first appeared in the sky in 1054 A.D., is perhaps the most famous supernova—"the optical analog of thunder"—in the interstellar dust, said Philip Morrison, Professor of Physics at M.I.T., in a lecture sponsored by the Richmond, Va., Public Schools this winter. (Photo: Harold M. Lambert)



For some time, Dr. Morrison said, this characteristic intensity vs. time curve for supernovae has been considered to be indicative of the nature of the stars' explosions. A number of theories about how supernovae explode have been based on this curve—indeed, have been tailored to fit the curve.

But according to his theoretical calculations, the curve only expresses the "thunder" and not the "stroke" itself, Dr. Morrison said, indicating that current theories about supernovae explosions thus have no observational support.

He suggested an analogy: 10 tons of T.N.T., or an atomic bomb, both create a mushroom cloud in the atmosphere. But there is no way of telling, by just looking at a mushroom cloud, whether it was T.N.T., an atomic bomb, or some other sort of explosive that caused it; the cloud is only the atmospheric manifestation of any explosion. The nature of the explosive cannot be read from the cloud.

Similarly, according to Dr. Morrison, the intensity vs. time curve of supernovae "doesn't tell us how a supernova works . . . This 'thunder' tells us very little about the nature of the explosion."

Hence, Dr. Morrison said, no one really knows what goes on inside a supernova as it explodes, which means that astrophysicists are presently pretty much in the dark about what's behind the "optical thunder" of supernovae.—Beverly Orndorff

This rocket, which Victor K. McElheny, Science Editor of the Boston Globe, describes as "about as powerful as a gnat," makes it possible for the Lincoln Laboratory's LES-6 communications satellite to keep itself on station without draining energy from fuel storage tanks and feed lines. A condenser (bottom of page) is charged from LES-6's solar cells; it discharges on command (up to 4000 times in eight hours) to create a spark across a tube of teflon; the spark vaporizes some of the teflon, which is emitted through ports (below) into space as a plasma—a tiny pulse of thrust.

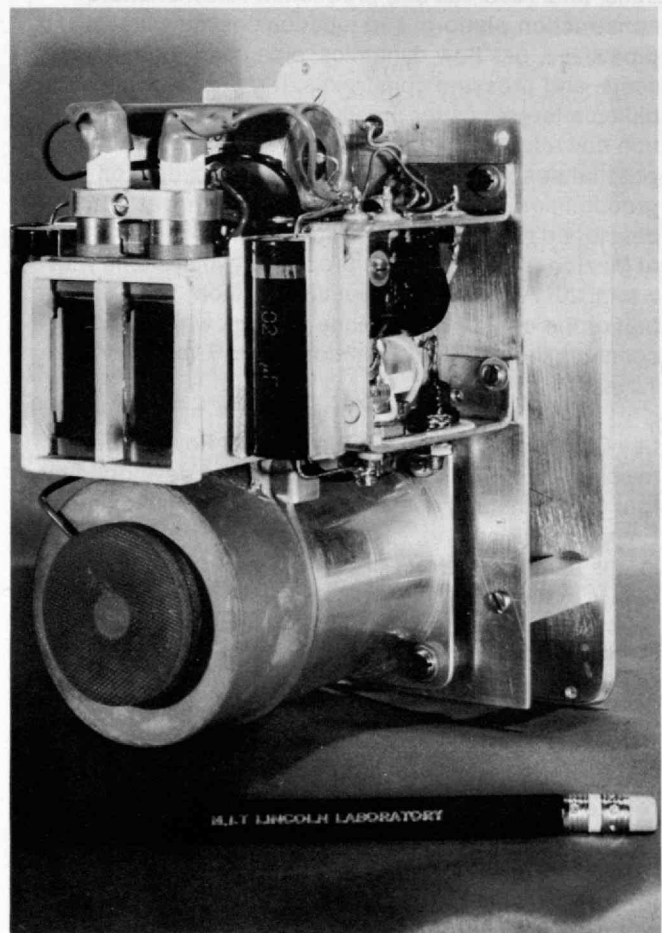
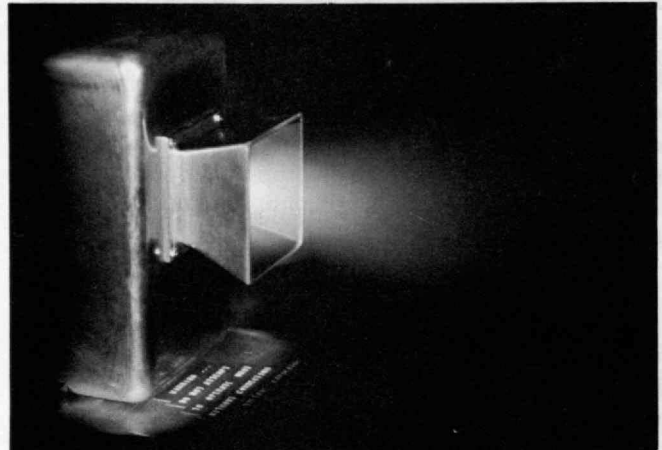
Microthrusters

The LES-6 (Lincoln Experimental Satellite) launched late in September from Cape Kennedy (see Technology Review for December, 1968, p. 76) is safely in its synchronous orbit, and Lincoln Laboratory engineers now report that all major experimental systems and equipment aboard have been successfully tested. Initial operation has been satisfactory in every case.

The Lincoln Laboratory tests of LES-6 include the first use in space of pulsed plasma microthrusters using a solid propellant—in this case teflon, familiar to many housewives as a kitchen worksaver. The teflon is converted into a plasma by the electrical arc generated by the discharge of a high-voltage capacitor.

The special feature of LES-6 is its ability to sense its own position in space and to correct for deviations from that position automatically. It makes the corrections by activating one or more of four pulsed plasma microthrusters to nudge itself back into position. Each pulse of electrical energy, lasting two or three microseconds, produces an impulse of only a few micropound-seconds, so that many, many pulses are needed to produce a perceptible effect on the orbit of the 360-pound satellite.

The microthrusters' electrical power is generated from sunlight by panels of solar cells; and the fact that the plasma generation is controlled solely by this supply of power gives the LES-6 an independent propulsion system which requires no outside energy sources and is inherently much simpler and more reliable than gas or liquid propellant systems which have been used heretofore, Lincoln Laboratory engineers report. The microthrusters were developed by Republic Aviation Division of Fairchild Hiller Corporation with support from the U.S. Air Force, and a first report on their design and operation was made this month in New York at the A.I.A.A.'s sixth annual Aerospace Sciences Meeting.



Pipeline Analysis

A new form of computer analysis, this time applied to the pipeline networks in which gas from offshore wells is gathered and carried ashore, promises to revolutionize the complicated and controversial pipeline construction business. And its proponents say it demonstrates the immense potential of modern technology for many government operations.

The capacity of a large digital computer is used in the new method to determine from the very wide range of available alternatives the most efficient gathering network for a given complex of wells and how system additions can best be made to reach new wells. The computer program takes into account gas field locations, total reserves and production rates, offshore construction platform and junction costs, available pipe sizes, gas flow dynamics, pipe costs, compressor costs, and pressure constraints. It reduces the several billion alternatives for pipeline design and construction down to a workable few of the most promising possibilities, and it incorporates complex data on future probabilities. The new computer program was actually developed to design gas gathering networks in the Gulf of Mexico off Louisiana. It proposed two systems with a total 20-year cost of about \$340 million, "less than half of the cost of the pipeline network which now connects the gas fields," according to *The New York Times*.

Lee C. White, Chairman of the Federal Power Commission, for which the new program was developed by four scientists and engineers working for the Office of Emergency Planning, says it is "a significant advance in gas pipeline network design." The results, applicable to all offshore gas pipeline construction in the U.S., "could result in significant savings to the consumer," Mr. White said at a Washington press conference this fall. And Senator Edward M. Kennedy, as Chairman of the Senate Special Subcommittee on Science, called the new program "a first taste of the kind of progress and savings which the public and the government could realize with more intensive matching together of scientific advances and governmental needs. We have barely scratched the surface of the potential application of sophisticated scientific advances to the everyday workings of government," he said.

Four scientists are listed by F.P.C. as "major contributors" to the new development: Daniel J. Kleitman, Associate Professor of Mathematics at M.I.T.; Howard Frank and William Rothfarb of the Department of Electrical Engineering at the University of California (Berkeley), and Kenneth Steiglitz, Professor of Electrical Engineering at Princeton University. They worked under the general direction of Howard Frank of O.E.P.

Dr. Kleitman, who simply says the analysis development "didn't take long," estimates that offshore pipelines may represent 20 per cent of the cost of bringing gas to customers. He told the Boston *Herald Traveler* this fall that the new analysis method may accomplish a 30 per cent saving in pipeline costs, making possible a 5 to 7 per cent rate reduction to customers. Senator Kennedy's office estimated cost savings at over \$300 million in two decades.

M.I.T. Studies Air Shipped by Air

Rushing samples of human breath from Logan Airport to the campus in Cambridge three times daily is one of the key processes in some research currently under way at M.I.T. Yes, air exhaled by humans, held in one-liter flasks, must be analyzed within hours—lest its value is lost to the search for peaceful uses of atomic energy.

Robley D. Evans, Professor of Physics, is making a comprehensive retrospective study of permissible levels of radium in the human body. "This is one of the basic problems of the nuclear power era," he explained, "and better standards of safety can help us determine better safeguards."

The analysis is made on a noble gas called radon, given off by the disintegration of radium, which works its way into the bloodstream and the lungs. If a significant amount of radium has been ingested, then significant, measurable amounts of radon will be exhaled in the person's breath. Since radon is highly perishable—it has a half-life of 3.8 days—breath samples need to be rushed to the M.I.T. Radioactivity Center as fast as possible.

Shipments of air come to M.I.T. regularly from all over the world—part of a continuing effort to establish a radium ingestion standard for humans. Radium in the body yields radon, a noble gas, upon disintegration, and work by Robley D. Evans, Professor of Physics, and Mary Margaret Shanahan centers upon measuring the minute amounts of radon in samples of breath from luminous dial-painters and others exposed to radium.



While sometimes shipments arrive as often as three times daily, an average of 10 shipments come into the Center every week.

The study, which derives from Dr. Evans' interest, has been going on since 1934 and has included samples from as far away as Japan. Breath of veterans of World War I are sampled as well as that of luminous dial-painters who made a habit of pointing their brush on their lips—thus ingesting radium. In addition, persons who took the radium-containing "medicine," Radithor, which doctors frequently prescribed during the 1920's for arthritis, hypertension, and gout, are studied for long-term effects.

The breath analysis is one of several studies Dr. Evans is conducting at the Radioactivity Center aimed at peaceful uses of atomic energy. Another component of the effort includes analysis of air samples from a Nevada bomb-test site, "in case we should ever have to study air as a means of detecting secret bomb tests," and environmental air from uranium mines. Shipments for the Center come from a network of prepaid deliveries managed by M.I.T. and Air Express, a Division of R.E.A. Express, with 34 domestic airlines.

Friends of Science

Weston E. Vivian was sent to Congress from the second district of Michigan in 1964—to the best of anyone's knowledge the first professional scientist or engineer (M.I.T., S.M. 1949) ever to be elected to the Congress. He served creditably (see *Technology Review*, Nov., 1966, p. 38) for two years but has tried twice without success to be returned. Last fall, when Dr. Vivian outlined to the corporate associates of the American Institute of Physics a view of the constituency trouble he sees for science, he may have been commenting on his own troubles as well.

There are three principal constituencies for science, Dr. Vivian said—the "pork-barrel," the "fascinated and hopeful," and the "accept-judgment."

With the increasing visibility of the \$17 billion-a-year budget for research and development, scientists can effectively appeal to their large "pork-barrel constituency." But most of this group are "not scientists at all," said Dr. Vivian. "They are the people who make scientific instruments and hardware. The man who helps assemble a Saturn booster is part of this hard constituency, but he's not a man you think of as a scientist."

Dr. Vivian told of a characteristic experience with this potent, hard constituency, during the recent campaign:

"In a news release I had said that the unmanned space program was excellent, but the manned space program was seriously overfunded. A large manufacturer of space equipment located in my district sent me a telegram advising that his company had a sizable contract under the manned space program employing several hundred people in my district. My observations certainly must have been misreported, he assumed. Would I correct the misimpression right away? I knew his company had the contract because I had assisted them in presenting their case. But I responded that times had changed, that an intractable budget problem existed, that the taxpayers had just been subjected to a 10 per cent tax surcharge, and that I was not prepared to ask for 2 per cent more solely to support the manned space program. His employees, previously my supporters, vocally endorsed my opponent."

One measure of the increasing penetration of magnetics into modern technology is publication. And the world output of publications on magnetics has risen six-fold during the past decade, I. W. Jacobs of the General Electric Research and Development Center reported last fall at the 14th annual American Institute of Physics magnetism conference; the number of listings in Physics Abstracts has similarly multiplied. (Chart: I. M. Jacobs)

A second science constituency, large and tolerant but not hard-attached, is "that appreciable portion of the general public that is fascinated by science and confidently hopeful that science will produce great benefits. The National Institutes of Health have learned to cultivate and marshal this constituency. Members of Congress are not about to be caught voting against money for cancer research and muscular dystrophy," Dr. Vivian said.

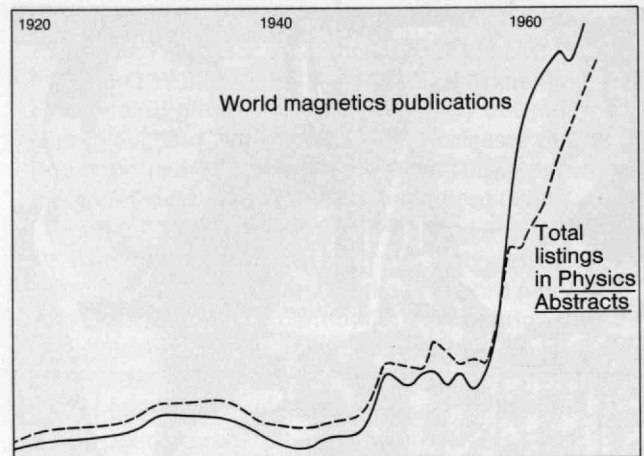
"But the largest science constituency," Dr. Vivian declared, "is the 'accept-judgment' constituency, which consists of the bulk of people, the typical voters, who think 'if that's what the President and the guys he asked say ought to be done, I suppose they're right, even though it sounds stupid to me.' When some prober gets a headline by asking why we paid for a study of 'The Characteristics of Left-Footed Kangaroos in Australia,' this constituency reacts sensitively, for it feels that its faith and loyalty have been taken advantage of. Because all scientists desperately need the faith of this constituency in the coming years, take its confidence to heart!" said Dr. Vivian.

Applied Magnetics

In today's sophisticated technology, magnetism is far more than the attraction of one magnetic piece for another. For the phenomenon of magnetism, affecting the way materials themselves behave and the way they influence other materials and forces around them, now has a unique role in control.

Two examples of this new technology were cited late last fall by Howard S. Jarrett (Ph.D.'51, M.I.T.) of the Central Research Department of E.I. du Pont de Nemours and Company at the American Institute of Physics conference on magnetism and magnetic materials. Both concerned the effect of magnetism on light, a field of "much technological interest," Dr. Jarrett said.

The plane in which polarized light waves vibrate is rotated as the light passes through or is reflected from a magnetic material. This phenomenon has been important in scientific research for many years, but today such practical devices as optical displays,



light modulators, optical memory units, and even tunable lasers are being made to depend upon this effect of magnetism.

Dr. Jarrett also described how, according to recent findings, light from lasers is scattered by the magnetic waves in a transparent magnetic material through which the light passes. This turns out to be a powerful tool for investigating fundamental properties of magnetic materials, and, said Dr. Jarrett, "it will not be long before applications are also being found for this new physical behavior that now seems to be of scientific interest only."

Magnet in the Bloodstream

A magnet that swims fish-like through the bloodstream directed by a guidance system outside the body was described this fall by Dr. Ephraim Frei, physicist and head of the Electronics Department of the Weizmann Institute of Science, Israel. Speaking on applications of magnetism to medicine at the 14th annual conference on magnetism and magnetic materials in New York, Dr. Frei reported on a tiny, flexible magnetic catheter (1/16 of an inch and smaller), with a permanent magnet tip, called the Pod, which can be threaded through the vascular system and swim fish-like through the bloodstream.

The Pod Magnetic Catheter was developed, and since refined, in Dr. Frei's laboratory in 1963. Propelled from outside the body by alternating magnetic fields, the catheter has been used experimentally since 1964 in the cardiovascular system of animals. Most recently it has been used on a patient in the United States suffering from a brain lesion.

The Pod is envisaged as being capable of serving as a major medical tool to (1) diagnose disease; (2) treat disease by carrying diagnostic materials and medication; (3) make possible the diagnosis and treatment of disease without surgery.

Subsidizing the Rich

Today's urban transportation represents a subsidy of the rich by the poor, says Siegfried Breuning, Director of M.I.T.'s Project TRANSPORT.

"If you look at public transit lines," Dr. Breuning said as a panelist at the 1968 Urban Design Conference of the Harvard Graduate School of Design, "you will find that the heavy usage which is usually associated with the ghetto and the downtown area is lucrative from the point of view of paying its way. The deficits occur in the low-volume feeder lines and in the low-density areas, where people with higher incomes live. So the poor subsidize the rich," he declared. And, Dr. Breuning continued, you can show very quickly that high operating cost occurs in a secondhand car rather than in a new vehicle.

Dr. Breuning offered two "interesting" solutions: Change the fare structure on the mass transportation system, replacing the equal fare with a graduated system which imposes higher fares for low-density service. And force automobile manufacturers to provide a five- or ten-year warranty. The first buyer of a car would pay more than he does now, Dr. Breuning said, but he would be giving up "the subsidy we are now getting from the second user of the car."

Torrey Reviews N.A.S.A.

Volta Torrey's *The Sleeve of Greatness* is subtitled "An Essay on the Impact of N.A.S.A." N.A.S.A., as any school child can tell you, is the acronym for National Aeronautics and Space Administration. We suggest that Mr. Torrey, a former Editor of *Technology Review*, has changed it to National Affirmation in the Space Age. For Mr. Torrey has written a lucidly articulate account of this nation's affirmation of will and purpose in exploiting its technological acumen to explore space, an essay which will appear as the final chapter of a 10-year history of the N.A.S.A. years prepared for the Lyndon B. Johnson Library.

No earlier decade was so filled with scientific accomplishment as the 1960's, and Mr. Torrey's purpose is to catalog the social and economic benefits that the nation derived from its substantial space investment. The list is long and dramatic, extending across a wide spectrum of accomplishment—stimulation of new advances in education; provocation of wider use of systems analysis patterned after successes in the space and defense environment; underpinning the economy of several communities in the so-called "fertile crescent" extending from Huntsville, Alabama, to Clear Lake, Texas; implementing improved international relations through co-operation with other countries in sharing space knowledge and technology (excluding an intransigent Soviet Union); transfer of technology through spinoffs from their N.A.S.A. orbit to applications in the industrial life of the nation.

Writing under such prejudiced auspices, the author would hardly be expected to dare refer to citizen ambivalence about N.A.S.A., expressed well by a noted professor of physics, Abraham J. Heschel, who asked: "Of what value will it be to land a man on the wilderness of the moon if we neglect the needs of millions of men on earth?" Must feelings of guilt over unresolved problems of ghettos dampen the exhilaration we justifiably feel about our national achievement in space? Although Mr. Torrey does postpone examination of this touchy question until page 58 of a 63-page chapter, the whole of the report—due for publication in the spring—provides well-documented answers.

1. Synthesis of a complement to the infecting viral strand and association of the resulting parental RF with a membrane site; note the gap in the complementary strand.

2. Semiconservative replication of the membrane-bound parental RF to generate progeny RF in the form of RF I.

3. (a) Conversion of progeny RF I to RF II by "nicking" of the viral strand. (b) Displacement of the viral strand from the RF with concomitant synthesis of a new viral strand. (c) Release of a single-stranded progeny DNA ring, identical to the input ring and already probably contained in an immature virus particle, and regeneration of a new progeny RF II molecule that is reused.

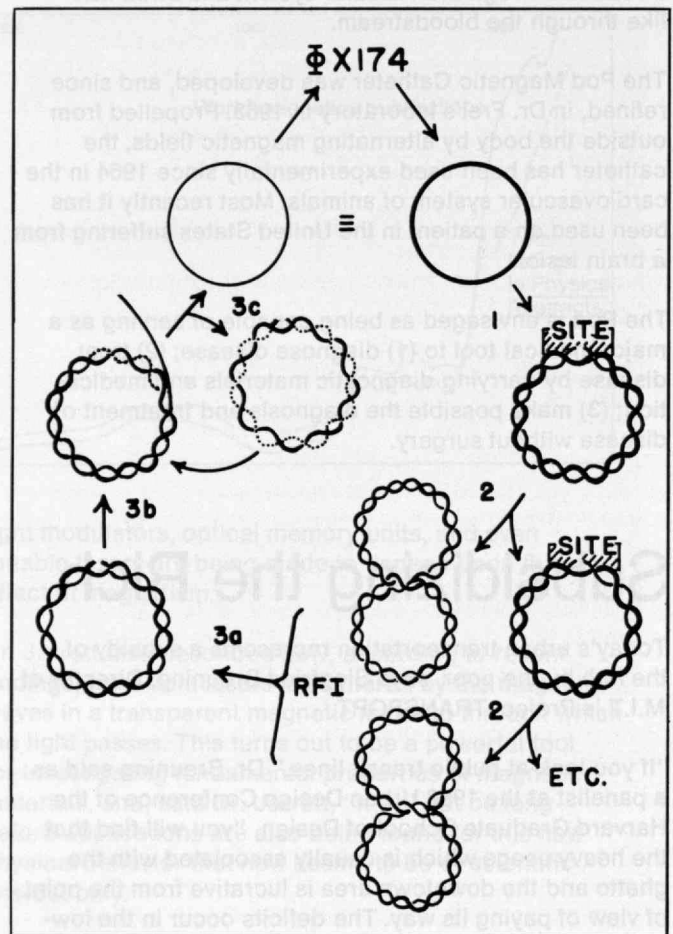
(From B. H. Lindqvist and R. L. Sinsheimer)

The Life Cycle Of Viral DNA

Some dozen years ago Robert L. Sinsheimer, who studied at M.I.T. in 1938-41 and now is Head of the Division of Biology at California Institute of Technology, chose to study, because of its uniquely small size, the bacterial virus ϕ X174—a bacteriophage isolated from the sewers of Paris and able to grow in that ubiquitous inhabitant of the human gut, *Escherichia coli*. As a consequence of that choice, many of the various molecular events accompanying the replication of ϕ X have been unravelled—to a large extent in Dr. Sinsheimer's laboratory at Caltech. Dr. Sinsheimer recently described this work in a seminar at M.I.T. and in a lecture before the prestigious Harvey Society, and the following is an account of this research.

One of the smallest DNA-containing viruses known, ϕ X has a particle weight of 6.2×10^6 daltons, 25 per cent of which is a single molecule of DNA. This DNA molecule was shown by Dr. Sinsheimer to be a single polynucleotide strand whose ends were linked together to form a ring. Recently, starting with the viral DNA as a template, it has been possible to synthesize this viral DNA *in vitro* in a biologically active form—thus confirming our knowledge of its composition and structure. (For an account of this work see Dr. Sinsheimer's paper "Closing the Ring" in *Technology Review* for July/August, 1968.)

The discovery that ϕ X DNA was single-stranded came as a surprise, since the DNA of all higher organisms is found in the self-complementary, double-stranded form first described by Watson and Crick. How a single-stranded DNA molecule would be woven into the fabric of living systems thus became a fascinating question, and one solvable only by an investigation into the fate of the single-stranded DNA ring in the ϕ X-infected bacterium. The first step in the solution to this mystery came when Sinsheimer showed that after entry into the cell the single-stranded DNA was incorporated into a conventional double-stranded DNA molecule, which he called replicative form (RF) since it replicated intracellularly. Other research carried on during this same early period established that the purified viral DNA (and also the RF) was itself capable of infecting



cells under certain conditions and giving rise to mature phage particles; this was the first demonstration of an infectious viral DNA molecule.

Genetic analysis of the virus using conditional lethal mutants (mutants able to grow under certain conditions but not under others) has led so far to the identification of seven ϕ X genes. Four of these produce protein components of the phage particle, one is concerned with the replication of the RF, one is involved in the synthesis of progeny single-stranded DNA, and the last is required for the release of phage from the cell. Most, if not all, of the viral genes have been identified, since the molecular weights of the ϕ X proteins characterized so far account for most of the 1800 amino acids that can be coded for by the 5500 nucleotide bases of ϕ X.

From the moment the RF was first discovered, studies on its mode of replication have been in progress. Only when the RF molecule occupies one of a very limited number of sites on the cell membrane can it replicate. RF molecules not associated with a membrane replication site do not replicate. As shown in the accompanying figure, the RF molecule which replicates is usually the one which contains the original viral strand that infected the cell; this RF is called the parental RF. It occupies the membrane site and replicates semi-conservatively to yield a progeny RF molecule, which is released into the cytoplasm, and a new membrane-bound parental RF molecule, which contains the original viral strand associated with a newly synthesized complement. The replicating RF molecules are usually in the form of RF II, a molecule comprising one circular and one linear strand. The progeny RF molecules are mostly in the form of RF I, in which both strands of the double-helical DNA are closed into interlocking rings. The parental viral strand in the replicating parental RF is always found as a circle, while the associated complementary strand is in an open linear form which may sometimes exist as a molecule larger than the unit ϕ X length. Pieces of DNA shorter than unit length are also found, and current research is focused on characterizing these various intermediates of RF replication.

An important element in our understanding of ϕ X replication was added recently with the discovery that the single-stranded DNA molecules found in progeny phage particles are formed from the progeny RF I by an asymmetric displacement process which probably involves the sequence of steps shown as 3a, 3b, and 3c in the figure. First the RF I molecules are enzymatically "nicked" in the viral strand (it is always the same strand which is found in the phage) to form RF II. The viral strand is then displaced from the RF II molecules thus formed while simultaneously a new viral strand is synthesized to replace the displaced viral strand. There is good evidence that this process occurs simply by elongation of the viral strand in the RF to produce an intermediate of the sort pictured. By a process we do not yet comprehend the displaced strand is closed into a ring and encapsulated into a mature virus particle. Once this particle is released from the cell the cycle is complete and poised to repeat itself in a new host.

How long this particular mode of virus replication has existed deserves comment. One can imagine that single-stranded DNA viruses are of recent evolutionary origin and are parasites of cells that contain elaborate enzymatic machinery for the repair of their own DNA; thus only the presence of these evolutionarily recent "repair enzymes" permit phage like ϕ X to exist. An alternative possibility is that the asymmetric production of free single-stranded DNA reflects an early and primitive mode of DNA replication and that the replication of cellular double-stranded DNA also involves an asymmetric process with single-stranded intermediates. In either case ϕ X should provide, and indeed is providing, key insights into the details of DNA replication in *E. coli*, and there is no question of the applicability of these insights to events of much greater concern to man than how ϕ X replicates.—David Denhardt

5,000 Ph.D.'s Can't Be Wrong

Although a recent study of 10,000 doctoral degree holders in all areas of training confirm the ancient adage that there's no money in teaching, half of them seem to find this no impediment to a happy life—they have spent their entire careers in academic employment.

The study, conducted by the Office of Scientific Personnel of the National Research Council, covered 10,000 Ph.D. holders who graduated from U.S. universities between 1935 and 1960, separated into four categories: (1) those always in academe, (2) those always in non-academic work, (3) those who switch from academic to nonacademic jobs, (4) those who switch the other way.

"Half of the Ph.D.'s surveyed spent their entire career in academic employment. One-fourth were employed entirely by nonacademic institutions—primarily business and industrial concerns and government agencies. The remaining fourth were about equally divided between categories three and four," the report stated.

Other findings of the Council study note that: "In general, academic salaries are less than 80 per cent of the nonacademic. Those switching out of academe were likely to get close to 14 per cent increases.

"Those who switched from academe to elsewhere, of course, did little teaching in their new jobs, but they had done less teaching in their academic jobs than did those who remained. Those who switched into academic positions were doing a moderate amount of teaching on their old jobs, and greatly increased their teaching time by the switch (12 to 50 per cent). A desire to teach, or to avoid teaching, therefore appears to be an important determinant of career patterns.

"More recent graduates tend to start at higher academic ranks, skipping the instructor rank entirely; and they advance more rapidly than their predecessors did. Half of the Ph.D.'s surveyed reached full professorships 10 to 12 years after receiving the doctorate. Advancement has been most rapid in the physical sciences, slowest in the humanities-arts-professions group."

The frustrations of the scientific community came to the surface this fall at M.I.T. in a remarkable undergraduate seminar series led by Nobel Laureate Isidor I. Rabi, Compton Visiting Professor of Physics (center): "Scientists have a new kind of analysis to contribute to national problems," but no scientist is really "in the inner sanctum of basic decisions where he should be on international military affairs," said Dr. Rabi. Victor F. Weisskopf, Head of the M.I.T. Department of Physics (left), was more optimistic: "I have no doubts there will be a change—the only question is how," he said. (Photo: Craig Davis from The Tech)



The Bomb Revisited

Today's generation of students has never known the soul-searching of those who went to work on the world's most powerful instrument of destruction. Would they do it again?

To the dismay and anger of some M.I.T. undergraduates (and to the aid of some very lively discussion) during a seminar on "The Scientist and Mankind" led by Nobel Laureate Isidor I. Rabi, Compton Visiting Professor at M.I.T. this winter, the answer from four former members of the Manhattan Project was, "Yes, under the circumstances."

Victor F. Weisskopf, Institute Professor and Head of the Physics Department, tried at a later seminar meeting to show the students the brighter effects of those decisions. If the bomb had not been used against the enemy, he said, "we would not have been able to impress the world with its terrible power." Dr. Weisskopf said that the horror of Hiroshima has played a large part in preventing use of atomic weapons since.

Dr. Rabi insisted that "you cannot discuss it from the point of view of 20-20 hindsight," and proceeded to try to explain the scientists' decision in a way which would be meaningful to their young audience.

Dr. Rabi said that the nation was under a threat to national security unlike any the U.S. has known since. The original decision to devise an atomic weapon was urged by those who had "felt the hot breath of Hitler," and the bomb as finally developed was used under the shadow of a fanatical Japanese resistance and also of uncertain relations with Russia, whose postwar power seemed very large.

Though many scientists now admit to feelings of ambivalence—"We worked hard to make it work even if we wished it wouldn't," said Bernard T. Feld, Professor of Physics at M.I.T.—the question of deploying the bomb arose when the scientists involved were victims of a kind of "mass mesmerization," Dr. Feld said. In the future, he said, decisions of this kind should not be made by people "on the inside. The last people to ask about deploying the anti-ballistic missile," said Dr. Feld, "are the people working on it."

Remember, too, said Cyril S. Smith, Institute Professor in the M.I.T. Department of Metallurgy and Materials Science and in the Department of Humanities, that no one can work at a job effectively "if he is continually re-evaluating the decision to work in the first place."

Dr. Rabi tried to find a lesson for the students from the profoundly disturbing experience which he and his colleagues had been trying to describe. It was this: Inform yourselves as fully as you can of the political and social context of your work, so that you can be as objective about the value of your work as you are about the work itself. Unless you do this, Dr. Rabi told his student audience, "you are a citizen simply narrowed by your education."

Freshening Winds of Change

Pressures for changes which will bring about a new relationship between students and faculty have made the year 1968 "positively sprightly" for American colleges and universities, says Paul E. Gray, Assistant Provost of M.I.T. "Today's university," he told M.I.T. alumni attending a year-end meeting in Boston, "is subject to reappraisal and change with extraordinary rapidity. And the winds of change are still freshening."

Effective higher education can today no longer be a curriculum-based effort determined by what the catalog says and measured by the students' grades. It must give each student a larger role in selection and performance, leaving as the teacher's function to set attitudes and character, to exemplify a "style of mind," to give the enterprise its fundamental quality.

The challenge for the next years, said Professor Gray, is to find ways of advancing this role for the students and faculty "while strengthening the delicate fabric of the university."

Three themes run through the events shaping the future of professional institutions such as M.I.T., said Professor Gray:

1. "Educational self-sufficiency" will become a fundamental goal of the educational program. It is now clear, he said, that "we educate in direct proportion to the innovativeness and critical power which we can give to our students." Because we cannot be sure of the professional environment in which they will work, our students need especially the ability "to dissect new situations, to decide what and how to learn on their own." To provide this innovative ability, said Professor Gray, we must blur and eventually

eliminate the line between teaching and research; the character of both must change so that they in fact become one.

2. In the same sense, education must become relevant to the students'—and to society's—needs, which are in fact one and the same. "Students are asking that institutions accept responsibility for the relevance of their education and of the institutions' goals to the ultimate needs of society," he said.

3. Participation in setting their educational goals will in itself be an educational experience for undergraduates. On this basis we need to give students a voice that is loud and clear, said Professor Gray. But it is not true, despite current student demands, that any university has an obligation to structure itself so as to engage in "participatory democracy," he declared.

The Growing Federal Commitment

So large is their investment in supporting the partnership between their government and the universities that the people of the United States now determine whether the quality and quantity of higher education is adequate or inadequate. Furthermore, declares Dr. Glenn T. Seaborg, Chairman of the U.S. Atomic Energy Commission, this "federal-university partnership in cultivating intellectual resources is permanent."

"I believe this partnership, as well as support in the lower schools, is based on acceptance by the public, the Congress, and the Executive of the fact that the young are a national resource," Dr. Seaborg said, addressing the Council of Graduate Schools in the United States this winter in San Francisco. "The development of that resource through education to the highest levels can be neglected only at our peril. Whether the quantity and quality of higher education in both private and state-supported institutions is adequate or inadequate depends primarily on the federal government."

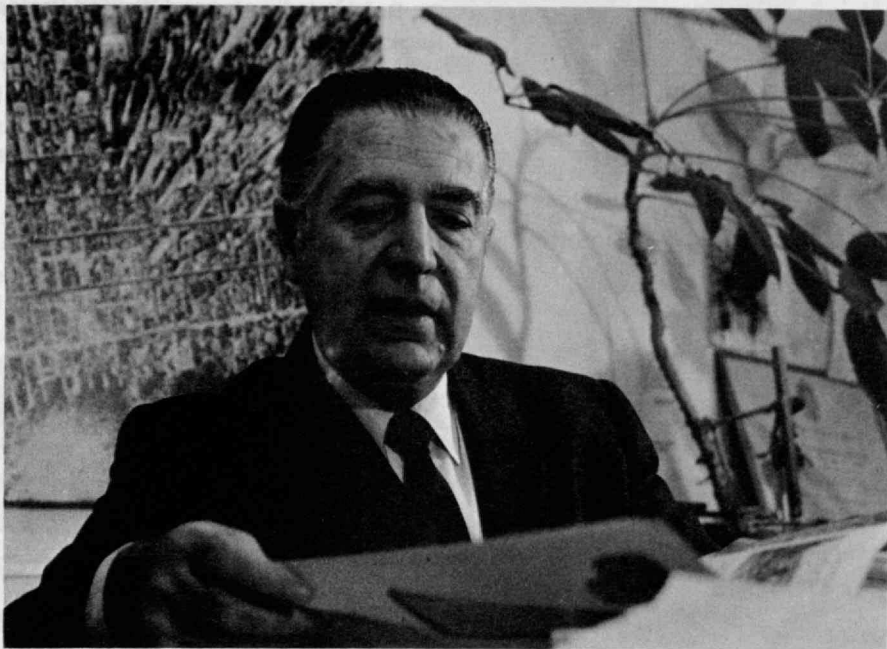
Dr. Seaborg listed three other "generalizations," as he called them, concerning the relationship between universities and the federal government. They were:

1. That the framework for adequate federal participation, broadly, in educational support is now largely available;
2. That federal support for education at the college and graduate levels is relatively nonpolitical; and
3. That the dynamics of the scientific revolution—the cycle of accelerating scientific and technological power, increasing productivity, greater leisure, and the demands for higher skills—seem to guarantee not only the permanence but the increase in federal involvement.

The current cutback in federal funds for research and development represents "an unavoidable and temporary" adjustment from the "dramatic and uninterrupted rise in federal financing started after World War II.

"I believe that in the years ahead ways will be found for stabilizing our government financing of the universities to avoid shock treatment, and also to provide for the moderate growth and funds essential for spontaneous creative initiative," Dr. Seaborg declared. And he noted the formula for science suggested by Donald F. Hornig, formerly Science Adviser to the President, providing a growth rate in research and development of 6 per cent per year, plus a "sophistication factor" of 1 to 4 per cent to take care of the growing complexity of research and equipment.

Fernando Belaunde Terry was President of Peru for five years, until late in 1968. Now, turned down by the electorate, he is lecturing in Cambridge—and working at Harvard University on an interdisciplinary case study of regional development. Peru's big problem, he said, is agrarian reform. Can it be done without foreign investment? No. But "I am a nationalist but not against outside finance," he told Technology Review. (Photo: Owen D. Franken)



"When a South American dictator is deposed, he goes to a villa on the Riviera. But when a South American president is overthrown, he goes to the classroom." This was the judgment of the recently deposed President of Peru, Fernando Belaunde, during a talk on Latin American Development to a large audience at M.I.T. this winter, sponsored by the Club Latino.

Dr. Belaunde focused on engineering, explaining that some excellent engineering theses could be written on such problems as transforming the jungle into farmland, constructing dam and canal systems, or some other novel project "as crucial to Latin development as the Pan American Canal." He said that he will be conducting a joint university seminar this spring which will be seeking out ideas for technological progress.

Dr. Belaunde predicted that in a generation, the countries of Latin America will be "good clients" for the products and technology of the highly industrialized nations of America and Europe. Among obstacles to this goal, Dr. Belaunde cited the political instability, lack of funds, and insufficient technical know-how which characterizes many Latin governments.

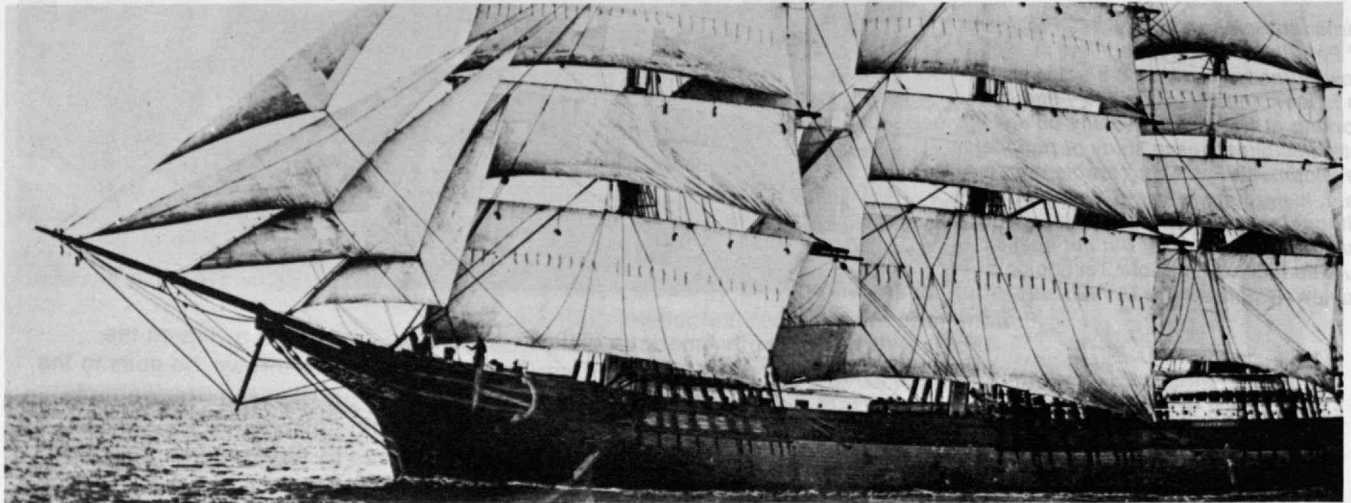
Despite the fact that military and dictatorial regimes often purport to improve nations at a rapid rate, Dr. Belaunde said his own conviction was that the best form of government for Latin countries is democracy. Socialism in Latin America would only mean more government bureaucracy, less rule by the people, and, hence, slower progress.

The former president, who taught architecture for 20 years before his successful campaign for the presidency in 1963, discussed the Latin concept of mutual aid, or the philanthropy of the poor. He said that in Peru, because people had no money with which to improve their communities, they invested their labor in building their own schools. Then it is up to the government to find teachers for these schools. He said that as a result of this tradition, 95 per cent of all Peruvian children are enrolled in schools, and that the nation has 80,000 school teachers.

Asked if foreign investments in Latin countries were resented by nationalist elements in the native population, Dr. Belaunde explained his concept of nationalism. "I am a nationalist, but not against outside finance. We need it to make our country better." He said that foreign capital was fine so long as

it was not presented in a "Big Stick," imperialist fashion. "So long as you create conditions where foreign capital is attractive to the people, you can avoid that sort of resentment," he said.

Dr. Belaunde has been a Visiting Professor at the Department of City and Regional Planning at Harvard since his government was overthrown by a military coup on October 3, 1968. Before his presidency, he was Dean of the Faculty of Architecture at the Universidad Nacional de Ingenieria of Peru. One of the main achievements of his term in office was the construction of the Andes Highway, a major transport artery along the mountain slopes of inland Peru.



Identity Search Is Not New—Johnson

"In the complex systems society in which we live, one of the most deeply felt needs is the quest for identity, the yearning for the person-sized contribution in a world where vast and impersonal systems solutions are clearly indicated," declared Howard W. Johnson, M.I.T. President, in an address this fall to the Society of Naval Architects and Marine Engineers. "This is a paradox and a major dilemma which leads many people to frustration and resignation from active involvement. And so it is with engineering education. The subject matter is complex; our ability to handle the complexity is enormous; but the end, the purpose of education, is man; and human nature rebels at the machine-like quality that is required of it to absorb vast amounts of information. How do we deal with this problem? How do we educate the modern marine engineer without having him feel lost—at sea, if you will—with the sheer vastness of the material?"

"In fact, this is not a problem limited to our times only, in this field," President Johnson pointed out. "Let me recall for you that 114 years ago, in 1854, the Boston Marine Society requested Captain Robert B. Forbes to deliver an address on the serious laxity of discipline observed in the clipper ships—and the ensuing damage to commerce and trade.

"The good captain spoke at some length, and in a somewhat patronizing manner, about the proper care of seamen. But he soon turned to the subject of the frustration and the overwhelmed reaction of the young seamen confronted with 'learning the ropes' in a big ship. I could not possibly do justice to the delightful style of Captain Forbes in paraphrase, so let me quote the passage for you:

An analogy from the days of sail: If the quest for identity is an issue for today's man, said Howard W. Johnson, President of M.I.T., to the Society of Naval Architects and Marine Engineers last fall, consider the seaman under clipper captain Robert B. Forbes, who spoke to the Boston Marine Society in 1854: "He would soon become discouraged at his futile effort; he would soon become disgusted with the absence of that poetry of the sea, about which he had heard so much; he would soon give up in despair. . . His highest ambition could not soar to the royal yard, for by this time he had become exhausted and useless." But for both, said President Johnson, there is a better way. (Photo: the Independence outward bound from Boston, 1884, from the Arthur H. Clark Print Collection, M.I.T.)

" 'The physical force of a boy on board of any large ship, be he ever so smart, would not be of much avail. He could not handle the royals or the other 'light sails'; his dizzy brain would become more dizzy when he ascended those tall masts, or 'layed out' on these long yards. In short, he would soon become discouraged at his futile effort; he would soon become disgusted with the absence of that poetry of the sea, about which he had heard so much; he would give up in despair when he attempted to get over that impassible gulf, the 'top rim'; he would sigh in vain for the old-fashioned 'lubbers' hole, now closed by modern improvement; and if by good luck he mastered the 'top rim' and got as far as 'the topmast cross trees,' he would look in vain for some 'rattline' to hang a conclusion upon; his highest ambition could not soar to the royal yard, for by this time he has become exhausted and useless. On the other hand, if the young sailor gets his nerves and muscles hardened to a certain degree in the duty of a small craft, where he becomes familiar with the road and with the leading of the many ropes, he embarks in a small ship with some confidence in himself. He looks forward with a laudable ambition to one day commanding a small bark or brig. He is not at the outset disgusted with his calling; he soon becomes a useful member of his little world, and repays the captain for his kind care.' "

President Johnson observed that "at a time when systems analysis is the password for modern education and modern technology, the words of a sea captain a century ago ring with special wisdom."

"What Is It That Waves?"

"We wanted to get the viewers away from the notion—which everybody picks up in school, including physics students at M.I.T.—that 'wave' equals 'wiggly line,'" explained Philip Morrison, Professor of Physics, in introducing his latest completed television venture, "What Is It That Waves?" Produced with Boston's educational television channel, WGBH, and shown three times this winter, "What Is It That Waves?" is one of several current projects Professor Morrison has under way for making the wonders and the problems of science accessible to the general public.

"What Is It That Waves?" keeps returning to the image of a line of up-right dominoes, which, when tripped at one end, falls down in sequence. "Did anything actually move down that line?" Professor Morrison asks a student during the program. "Yes, something did . . . but the big question, which scientists are still unable to answer, is . . . what?" The program uses a talk on the sonic boom with Professors Ascher Shapiro and William Shurcliff, and interviews with bystanders in Boston Common, the Boston Ballet, and a Gloucester fisherman. Pointing to the difficulty we have in grasping the notion of wave motion, Professor Morrison said, "If we had been a race of fishermen, and spent our lives continually rocking in boats, the notion of a stable surface would seem strange, and the notion of wave motion would be easy to understand. Our science would have been the same, but it would have had a totally different history."

Professor Morrison, co-author of *Physics*, the Physical Sciences Study Committee high school textbook which is used nationally, is also involved in two other major television projects. One is a two-hour special program titled "The New Astronomy," now being filmed with the British Broadcasting Corporation and the Public Broadcast Laboratory of N.E.T. Another is a series of six hour-long lectures for the Royal Institution in London for young audiences. The title of Professor Morrison's series is "Gulliver's Laws: The Physics of Large and Small." The lectures were televised over the Christmas holiday while they were delivered to live audiences. They included such titles as: "Lilliput and Brobdingnag Since the Industrial Revolution," "Dwarf and Giant Numbers," and "Beyond the Map." Finally, Professor Morrison plans with WGBH to do another hour-long program similar to "Waves," with "Energy and Entropy" as a tentative subject.



A Gloucester fisherman, an oceanographer, and three ballet dancers are among the stars of "What Is It That Waves?" a new television film about wave motion made by WGBH-TV, Boston's educational television station. But the principal performer is Philip Morrison, Professor of Physics at M.I.T., whose ability as a raconteur of physics for young people was also recognized by his selection to give the annual Christmas Lectures at the Royal Institution (London). (Photo: George Cope, Education Development Center)

Daniel P. Moynihan, Director of the Joint Center for Urban Studies of Harvard and M.I.T., grinned happily with President-Elect Richard M. Nixon in New York when it was announced that he would be Mr. Nixon's Special Assistant for Urban Affairs. Robert C. Seamans, Jr., Hunsaker Professor of Aeronautics and Astronautics at M.I.T. (right), worried only about house-hunting in Washington at his press conference following announcement that he was to become Secretary of the Air Force. (Photo left: *Wide World*)



The Washington Parade

Speculation and concern yielded to surprise and confidence as the "musical chairs" of changing Washington administrations picked and returned its academic "experts" this winter.

Henry A. Kissinger, Professor of Government at Harvard, was an early selection as a Special Assistant to President Nixon on National Security Affairs; and even those who disagree with his moderate-right positions took comfort from the reasoning academic background from which they come.

The appointment of Daniel P. Moynihan, Director of the Harvard-M.I.T. Joint Center for Urban Studies, as Special Assistant on Urban Affairs was far less obvious, both because the post was new and because of Dr. Moynihan's earlier identification with the Kennedy and Johnson administrations. But after the announcement both local and national press were quick to find consistencies. Martin Nolan of the *Boston Globe* noted that Dr. Moynihan's "frank views of liberal prejudices" and of the increasing size of the federal establishment have led to his being "drummed out of the club" among Cambridge liberals. And Leroy Aarons, previewing in the *Washington Post* and *Los Angeles Times* a soon-to-be-published book by Dr. Moynihan, noted that he seems to favor a "go-slow approach to social problems. If Dr. Moynihan has his way," wrote Mr. Aarons, "the Nixon era is likely to be one of great caution in the arena of social experimentation."

M.I.T. joined the rest of the nation's scientific community in applauding the selection of Lee A. DuBridge, President of the California Institute of Technology, as Assistant to President Nixon for Science and Technology. "Dr. DuBridge is an excellent man to deal with the complex of problems called science policy," George B. Kistiakowsky, Professor of Chemistry at Harvard and himself a former Presidential science adviser, told Robert Reinhold of the *New York Times*. "He has a very rich experience and very active concern over the relations of the federal government with the universities." Howard W. Johnson, President of M.I.T., told Mr. Reinhold it was "a very strong appointment," and Jerome B. Wiesner, Provost, said it was "great." (Dr. DuBridge is well known at M.I.T. through frequent conferences between the Institute and the California Institute of Technology and through his leadership of the M.I.T. Radiation Laboratory during World War II.)

Dr. DuBridge will begin work in Washington with two study groups—one on science headed by H. Guyford Stever, President of Carnegie Mellon Univer-



sity, who was a member of the M.I.T. faculty from 1946 to 1965, following his graduation from California Institute of Technology; and one on space headed by Charles H. Townes, Professor of Physics at the University of California—also a Caltech alumnus—who was M.I.T. Provost from 1961 to 1966.

The first to receive an assignment from Mr. Nixon as President-Elect was Charles L. Miller, head of the M.I.T. Department of Civil Engineering, who was named in November to head a task force on transportation problems.

Professor Miller's group was asked to prepare a private report to advise the new Administration in all areas of transportation, including a set of new ideas, recommendations, and proposals for executive action and new legislation for national transportation programs and policy. The final report was presented privately to President Nixon and his cabinet in New York on January 11.

In early January, Robert C. Seamans, M.I.T. Jerome C. Hunsaker Professor and formerly number two man at the National Aeronautics and Space Administration, was appointed to succeed Harold Brown as Secretary of the Air Force. At a press conference following the announcement, Dr. Seamans said, "I know the experience I've had at N.A.S.A. can be of use to the Air Force. It was a challenge I couldn't turn down." However, Dr. Seamans said he would remain at M.I.T. a month after President Nixon's inauguration, "to wind up my commitments"; and he added that Secretary Brown had agreed to stay on until February 15, when he becomes President of Caltech.

Among Those Returning

Meanwhile, as some arrived in Washington others departed. Robert C. Wood, on leave since 1966 to be Under Secretary (and for two weeks in January, 1969, Secretary) of the Department of Housing and Urban Development, returned in January to resume his faculty post in the M.I.T. Department of Political Science and to become, as well, Director of the Joint Center for Urban Affairs of Harvard and M.I.T. And Walt W. Rostow, who was Professor of Economics at M.I.T. in 1961 when he was tapped to join the Kennedy administration, took a teaching post at the University of Texas.

Because he did not return to M.I.T. and because of his "hawkish" position on the Vietnamese war, Dr. Rostow's decision attracted some special attention in the press. James Reston, Executive Editor of the *New York Times*, opened the issue by pointing that "this is not standard operating procedure," though he admitted that M.I.T. had "no legal or even moral obligation to invite him back." (Dr. Rostow had terminated his leave of absence in 1965, when he elected to remain in Washington while the Department of Economics felt that it needed a sense of continuity among all its tenured faculty.)

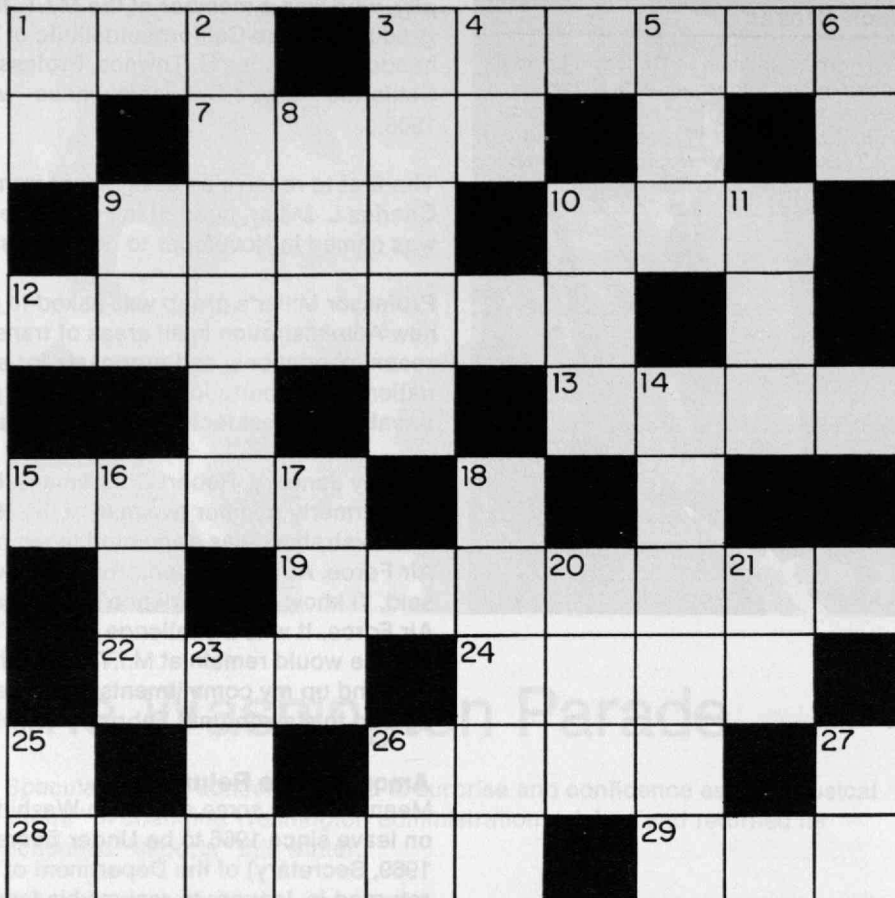
Was Dr. Rostow's position on Vietnam policy the real issue? No, insisted his former colleagues at M.I.T.: Dr. Rostow's former post is no longer vacant, as was made clear in 1965; Dr. Rostow's own interests have changed from economic history, which he was teaching at M.I.T., to political development; and—what is central to the case—Dr. Rostow's "calibre as a scholar," an issue completely independent of his Vietnam position, was called into question by his former colleagues.

And while *The Tech*, M.I.T. student newspaper, lamented that this rich experience in government would as a result be denied to present M.I.T. undergraduates, E. Cary Brown, Head of the Department of Economics, recalled for its editors that eight years ago students were "constantly grumbling about (Dr. Rostow's) lectures."

To clear the air, Dr. Rostow wrote to the *New York Times* that he and Mrs. Rostow were "grateful to those universities that did offer us posts at this time. But," he emphasized, "no university was under a legal, moral, or any other kind of obligation to do so." And, he said to put a further damper on discussion, "this is a matter strictly for the faculties concerned."

Techno-logical Crossword

For the correct solutions to this puzzle bearing the earliest postmarks for each Zip Code area (the first digit of the five-digit Zip Code), *Technology Review* will award a special M.I.T. souvenir. Send solutions and comments to Mr. Sandor in care of the Review, Room E19-430, Massachusetts Institute of Technology, Cambridge, Mass., 02139.



Clues across:

1. He goes up and down, backwards and forwards. . . (3)
3. . . . she also goes backwards and forwards, holding her hands back to back endlessly. (6)
7. Wander around and break up an amor! (4)
9. By the sound of it, an animal is in trouble. (4)
10. Such respect may come in only a week! (3)
12. No expression fits this word. (7)
13. (See 3 down).
15. It goes up and down, backwards and forwards, again and again until it dies. (4)
19. Now that the tumultuous revels have come to nought, it is surely time to do this again? (7)
22. Eva is upset by this greeting. (3)
24. This is piled up in the apartment. (4)
26. A fairy that is ripe for a change! (4)
28. In this theatre, morality plays apparently give rise to some agitation! (6)
29. In the A.M. or P.M., a count must be kept of disturbances. (3)

Clues down:

1. Shooting this makes a sensation in France! (2)
2. An inspiration in the training of top caliber athletes? (6)
- 3 and 5 down, and 13 across. . . . What we've all been wishing for. (5,3,4)
4. Morning existence? (2)
5. (See 3 down).
6. It sounds like a lofty greeting. (2)
8. "Mark it, Cesario; it is — and plain." (Shakespeare, *Twelfth Night*) (3)
9. Deities are so addressed; though less and less frequently nowadays. (2)
10. It sounds like an affirmation about the direction not to limit your choice! (3)
11. Tea break gives an opportunity to read a letter in the original Greek! (3)
14. Make a lightning streak for the French pastry. (6)
16. In England, tea for two leads easily to popular dance. (6)
17. Rich or poor, it is eventually exploited and worked into the ground. (3)
18. Escort into a house that has come down in the world? (5)
20. "Inch-thick, knee-deep, — head and ears a fork'd one." (Shakespeare, *The Winter's Tale*) (3)
21. In short, a second fiddle who sounds like a leader of the bass! (2)
23. Contest for life? (3)
25. A tiny mountain that sounds uninhabited? (2)
26. A small-scale operation is sent up the river in Italy. (2)
27. You must bring back the manuscript to get this degree. . . (2)

Mr. Sandor, a graduate of the University of Cambridge, is studying for his doctorate in the M.I.T. Department of Metallurgy.

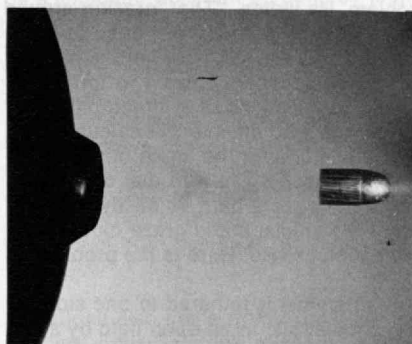
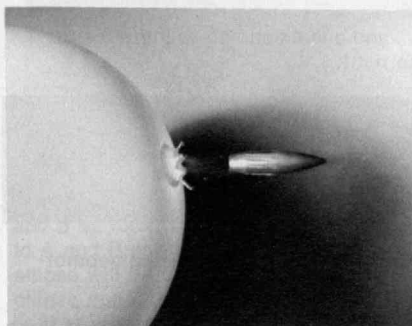
The correct solution to Dr. David L. Holt's Tech-Crostic published in *Technology Review* for January is the following quotation from Howard W. Johnson in the M.I.T. Bulletin: "The M.I.T. student wants and expects early responsibility, and in this he is like all of the M.I.T. students who have gone before him. He wants to become an effective participant in the world's affairs and a mature dreamer of what the world of tomorrow could become. The faculty of the Institute welcomes those who share this spirit and who seek to join this bold company."

At press time, 98 correct solutions to Tech-Crostic had been received by Dr. Holt in response to the *Review's* prize offer. As a result, the following first responders from each state are receiving, with the *Review's* compliments, copies of the M.I.T. Press Paperback edition of *Reflections on Big Science*, by Alvin M. Weinberg:

Arizona—Douglas J. Hoylman, Tucson.
California—William J. Wagner, San Carlo.
Colorado—David W. Seldin, Boulder.
Connecticut—Mr. and Mrs. Robert W. Poole, New Canaan.
District of Columbia—Mr. and Mrs. John Munzer.
Delaware—Joseph Lazar, Wilmington.
Florida—Joseph Slifer, Jacksonville.
Idaho—Robert A. Cushman, Idaho Falls.
Illinois—Michael R. Leavitt, Chicago.
Indiana—Bruce P. Layton, West Lafayette, and H. M. Oshry, Crawfordsville.
Maine—Mrs. Charles A. Roberts, Portland.
Maryland—Morton D. Cohan, Silver Spring.
Massachusetts—John C. Hitt, Cohasset, and Henry B. Kane, Lincoln.
Michigan—James S. Kaltenbronn, Ann Arbor.
Missouri—John C. Evert, St. Louis.
New Jersey—Mrs. Martha H. Redi, Princeton, and G. M. Zriny, Berkeley Heights.
New York—Samuel Wagstaff, Jr., Ithaca.
North Carolina—J. C. Morrow, Chapel Hill.
Ohio—Dr. J. J. McHugh, Toledo.
Pennsylvania—J. E. Hazard, Swarthmore.
South Carolina—John P. Ramsey, Seneca.
Tennessee—Mrs. Houston K. Payne, Hixson.
Texas—Stanley G. Reiff, Forth Worth.
Virginia—Charles L. Dorian, Arlington.
Washington—George L. Hadley, Seattle.
West Virginia—Ben Woodruff, Charleston.
Wisconsin—Robert G. McKean, Madison.

A prize also goes to Henry S. Lieberman of Newtonville, Massachusetts, the first of several readers to note (in his words): "The quote from Hamlet (W and Z₁) is of course Polonius' charge to Laertes against *lending* (borrowing is treated separately so that lending means only lending in this context)."

Strobe Probe



Two bullets are photographed emerging from balloons. The top picture shows a .30-cal. projectile (2800 ft./sec.), the bottom a .22-cal. bullet (1200 ft./sec.). Why the difference in the holes? (See the answer on page 75.)

Dr. Edgerton, a pioneer in the technology and art of high-speed photography, is Institute Professor Emeritus in the M.I.T. Department of Electrical Engineering.

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Puzzle Corner

Allan J. Gottlieb

Since this issue contains solutions to problems published in October/November, I am keeping my introductory yak-yak to a minimum.

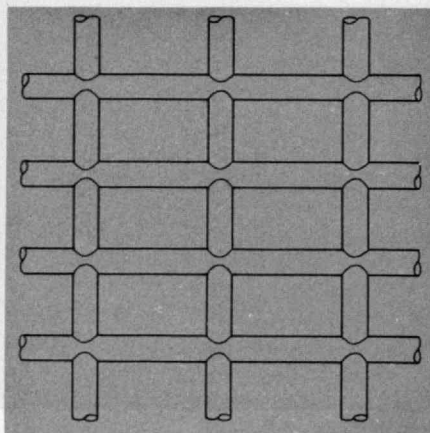
But I want to renew my plea that everyone mention the problem number with every comment or answer. And I ask that we finally put to rest all of last year's (Volume 70) puzzles—even the bridge problems!

Problems

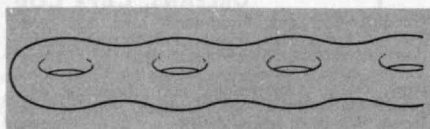
Recently I met a few of my colleagues from M.I.T. They mentioned that they read the column but are sorry to see that no "mathy" problems appear. Of course, they had none to submit, but I will respond with the following challenge.

The following was explained to me by Mike Spivac (of *Calculus on Manifolds* and *Calculus Calculus Calculus Calculus Calculus Calculus Calculus Calculus* fame). It concerns the classification of noncompact, nonbounded 2-manifolds.

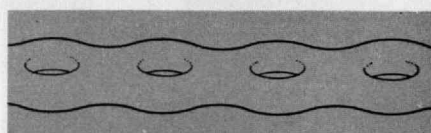
16 Consider the surface of an infinite jail cell, which extends up, down, left, and right:



And two infinite holed tori, one extending to the right:



... and one extending to the left and the right:



Are any two of these three homeomorphic? Why, or why not?

Frank G. Smith has another grazing problem. He writes, "That 'grazing around a square barn' puzzle was not so bad. Even I could solve it. Now here is one I can state but cannot solve. I've forgotten types and equations of symmetrical curves and also my integral calculus. So I leave this one for the 'math boys' to solve. And don't give it to that one who solved the square barn so easily and forgot the animal could graze clockwise and anticlockwise! Here is the problem:

17 If an animal is tethered to one side of a circular silo in an open field by a rope with length equal to the circumference of the silo and can graze over an area of one acre, what is the outer diameter of that silo?"

The next problem, from R. Wells Johnson, is reprinted from the Bowdoin College magazine:

18 It is always possible to find arbitrarily long sequences of consecutive composite numbers. Suppose, for example, that we wish to find five consecutive composite numbers. We define $6! = 1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 = 720$. Then numbers

$$6! + 2 = 722$$

$$6! + 3 = 723$$

$$6! + 4 = 724$$

$$6! + 5 = 725$$

$$6! + 6 = 726$$

are all composite; 722 is divisible by 2, 723 by 3, 724 by 4, and so on. Is this the first time in the sequence of natural numbers that there are five consecutive composite numbers?

Here is what everyone has been waiting for—another bridge problem! It is "for real," as described last year by Mel Creem in the Boston Globe: "The latest series of I.M.P. scored pair events re-

sulted in victories for Owen and Phyllis Rye at the Chess Club and for M.I.T. Students Bob Cohen and Marty Levin at the Cavendish Club. We have noted the high caliber of play of many of the young M.I.T. players. For example, in a set match with Dick Freedman and Ken Lebensold against tournament veterans Les Popper and Norman Humer, Lebensold, as declarer, made a singular contribution to the M.I.T. victory in this deal:"

19 Neither side vulnerable:

North

♠ Q J 7 3 2

♥ K 6 5

♦ A 6

♣ 10 8 2

West

♠ 9 8 6 5

♥ J 9 7

♦ K

♣ J 9 7 6 5

East

♠ K 10 4

♥ A 3 2

♦ 7 5 4 3 2

♣ Q 3

South

♠ A

♥ Q 10 8 4

♦ Q J 10 9 8

♣ A K 4

The bidding:

North	East	South	West
Pass	Pass	1 ♦	Pass
1 ♠	Pass	2 ♥	Pass
3 ♥	Pass	4 ♥	Pass
Pass	Pass		

The opening lead: ♠ 5.

In examining a problem from last year, Robert D. Scott finds a subtler one for this year. He writes:

"Mr. Hovemeyer in your July/August, 1968, issue of *Technology Review* makes his point well regarding problem 5 in the October/November, 1967, issue. (The original problem: express the volume of a regular dodecahedron in terms of the length of an edge.—Ed.) I also find it disconcerting to see such a poor approximation given for such an elegant principle as proposed by Mr. Severn.

"Having previously cut a few regular dodecahedrons in crystal and wood. I became interested in solving the problem myself, as Mr. Severn's terms in the printed solution were not too easy to understand. Doing so I find there is a lot

of magic in the dodecahedron and suspect I've only found part of it.

"My first solution was:

$$V = 5 a^3 \tan^2 54^\circ \sin 54^\circ$$

which seems more tolerable than Mr. Hovemeyer's solution and oddly enough depends on the unusual facts that

$$2(\sin 54^\circ) = \sqrt{1 + 2(\sin 54^\circ)}$$

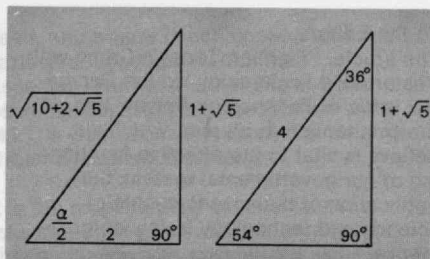
$$= \tan \alpha/2 = (1 + \sqrt{5})/2$$

$$= \tan (\sin^{-1} [1/(2 \sin \pi/5)])$$

$$= \tan [(\pi - \tan^{-1} 2)/2]$$

where $\alpha = 116^\circ 34'$, the dihedral angle of the regular dodecahedron.

"The following two basic triangles of the dodecahedron are in effect the route to an even less complex solution:



Using these relationships, then, my final solution is

$$V = [(5 + 5\sqrt{5} + 5)/(5 - \sqrt{5})] a^3 = 7.663119 a^3,$$

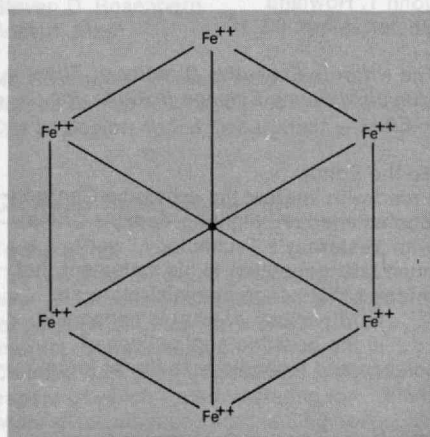
which probably means that there is another puzzle for you:

"20 Solve the original problem—express the volume of a regular dodecahedron in terms of the length of an edge—without the use of trigonometry. (Is this mystical preponderance of fives due to the pentagonal basis of the dodecahedron?)"

Speed Department

SD8 How come the year in which the British constitution was written has no prime factor?

SD9 What is this?



Solutions

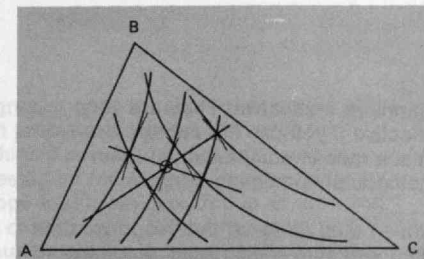
The following solutions are to problems which were published in the October/November issue of *Technology Review* (p. 92). Readers are invited to contribute solutions to the problems first published

(above) in this issue of the *Review*; they will be printed in the third succeeding issue (May).

1 Given an arbitrary triangle, find (by geometrical construction) the point such that the sum of the distances to the three vertices is a minimum.

Many fine solutions were submitted. Some relied on physics, others on calculus. But only the proposer did it geometrically, as desired:

"Consider the triangle:



Construct a family of ellipses having A and B as foci. The sum of the distances to A and B at any point on a given ellipse will be constant. Now for each ellipse constructed, determine the point on that ellipse such that the distance to C is a minimum (this can be done by finding the point of tangency of a circle drawn from C). This will yield a series of points through which a curve may be drawn (the curve DE, above). This procedure can be repeated for points B and C as foci and another curve drawn with A as the vertex to which distances must be a minimum. Since the point of minimum distance must be located on both DE and FG, the intersection of both curves is the required point."

Solutions also came from Russell L. Mallett, Jules Sandock, Michael Goldberg, W. Allen Smith, Glenn Stoops, F. T. Leahy, Jr., and Mark Yu (whose solution was geometric—but complicated).

2 Find all integral solutions to $x^2 - 8xy - 2y^2 - 6x + 1 = 0$, noting the possibility that none exists.

Mr. Stoops noticed that $x^2 - 8xy - 2y^2 - 6x + 1 = (3x + 1)^2 - 2(x - y)^2$, so any integer solution would show that $\sqrt{2}$ is rational.

Also solved by John E. Prussing, Guy F. Boucher, Alexander Bogan, Jr., P. W. Parsons, Eric Rosenthal, Douglas Hoylman, K. B. Blake, Russell L. Mallett, Norman M. Wickstrand, Jeffrey S. Passel, Harry Simon, and Messrs. Yu and Smith.

3 Consider the series

$$\sum_{n=1}^{\infty} \sin(n! \pi x).$$

- Show that it converges when x is rational.
- Show that it converges when $x = e$.

c. Find a value of x for which the series diverges.

Once again the best response was by the proposer, in this case Mr. Hoylman:

a. Let $x = p/q$, p and q integers. Then if $n \geq q$, $n!$ contains q as a factor, so $n!x$ is an integer. The sine of an integral multiple of π is zero, so in this case the series contains only finitely many nonzero terms.

$$\begin{aligned} \mathbf{b.} \quad e &= 1 + 1 + 1/2! + 1/3! + \dots \\ &+ 1/(n-2)! + 1/(n-1)! + 1/n! \\ &+ 1/(n+1)! + 1/(n+2)! + \dots \\ n!e &= n! + n! + n(n-1) \dots 3 + \dots \\ &+ n(n-1) + n + 1 + 1/(n+1) \\ &+ 1/[(n+1)(n+2)] + \dots \end{aligned}$$

Let $I_n = N! + n! + \dots + n + 1$ and $r_n = 1/(n+1) + 1/[(n+1)(n+2)] + \dots$

Then I_n is an integer of the same parity as $n+1$ (since every other term has $n(n-1)$ as a factor and hence is even, and

$$1/(n+1) < r_n < 1/(n+1) + 1/(n+1)^2$$

$$+ 1/(n+1)^3 + \dots = 1/n.$$

$$\text{So } \sin(n! \pi e) = \sin(I_n \pi + r_n \pi)$$

$$= (-1)^{n+1} \sin(r_n \pi)$$

$$\text{and } \sin \pi/n > \sin(r_n \pi) > \sin \pi/(n+1)$$

$$> \sin(r_{n+1} \pi) > \dots$$

since \sin is an increasing function. So we

have an alternating series in which the

terms are decreasing in absolute value

and tending to zero (since \sin is continuous and $\sin 0 = 0$). Hence it converges.

c. Let $x = 2e$. Then, with the same notation as above,

$$\sin(2en! \pi) = \sin(2I_n \pi + 2r_n \pi) =$$

$$\sin(2r_n \pi) > \sin 2\pi/(n+1)$$

$$> \pi/(n+1)$$

for sufficiently large n (since $\lim_{x \rightarrow 0} (\sin x)/x = 1$), hence $(\sin x)/x > 1/2$ for x

sufficiently close to zero). Hence this

series dominates a harmonic series, so it

diverges.

Also solved by D. Thomas Zerwilliger and Messrs. Prussing and Stoops.

4 No takers as yet. Keep at it!

5 I can't figure out cryptograms or their solutions, so I shall simply reprint a solution from B. M. Rothleder without making any claims at understanding:

"The key word is the author's name; the crypt is:

A B C D E F G H I J K L M N

D B S I L V E R M A N C F G

O P Q R S T U V W X Y Z

H J K O P Q T U V W X Y Z

The solution is: 'A non plus clue not used MIT mag so wild guess author HOJO thus key to crypt is to know platitudes stop DBS.' " (Mr. Rothleder notes errors in the italicized letters.—Ed.)

Also solved by Robert Sinnott.

Mr. Gottlieb, who graduated from M.I.T. in mathematics in 1967, is a teaching assistant at Brandeis University. Send answers and problems to him at the Department of Mathematics, Brandeis University, Waltham, Mass., 01254.

Correspondence Review

Science and the Law

To the Editor:

On the whole Mr. Boehm's article ("Fighting Today's Crime with Yesterday's Technology," *Technology Review* for December, pp. 50 ff.) provides an accurate summary of the President's Crime Commission Science and Technology report. I would like to clarify two issues, however—the linking of Chicago's communications center with communication centers using pneumatic tubes or moving belts, and the radio frequency allocation situation within Chicago. While suburban Chicago forces might suffer radio congestion, the fact is that Chicago itself utilizes 29 radio frequencies at present.

The pictures and the accompanying captions illustrated Chicago's current computer inquiry capability, and they demonstrated the fact that the dispatcher himself answers the citizens' calls except under overload conditions. Chicago has a one-number system that automatically assigns the caller to the dispatcher covering the area where the call was placed. While this system is not the computer-controlled center described in the article, it represents the finest police department communications center now in existence. The system in the article represents the next improvement cycle, but the Chicago system cannot be lumped with other current systems in police departments.

Again, the fact that 49 out of 50 burglar alarms are false may or may not be true. But, from 1 January 1968 to 31 August 1968 the American District Telegraph Company in Chicago reported 1,475 attacks on their customers' premises. These attacks could be simple vandalism or burglary, but 485 captures resulted.

This figure of 33 per cent compares to a nationwide clearance rate against burglary of 20.3 per cent and a Chicago rate of 34.0 per cent during 1967. The figure of 33 per cent arrests is even more dramatic, since a case clearance does not necessarily mean an arrest for an offense. The unqualified statement of a high false alarm rate could lead a reader to regard burglar

alarms as ineffective. They are very effective if you use the capture-to-attack ratio in comparison to other methods of combating burglary.

While I tend to agree that response time is important in some cases, an operations researcher should ask whether the system effectiveness measure of a department should be response time. In Chicago all reports of index crimes, non-index crimes and traffic accidents do not constitute even 30 per cent of the total calls for police service. Thus, the citizens use the Police Department for non-criminal matters the vast majority of the time. An expenditure of millions of dollars for a system to shave a few minutes off the response time should require more justification than a sample of 1905 index crimes. In addition, the planners must decide whether other improvements or services which compete for these millions of dollars will benefit the citizens more.

I do not want this letter construed as opposition to any of the ideas discussed in the article. Certainly, the Department of Justice, the Chicago Police Department, and my group believe that operations research can benefit the area of law enforcement—or we couldn't hold our present position. The problem of selecting the proper measures of effectiveness for a police department, however, has not been solved. The use of partial measures of effectiveness dealing with criminal apprehension, public safety, and public service must be used—but with caution. An improper choice of these measures can result in large expenditures of funds and the application of science and technology to the wrong problems. Only the care of individual researchers and the scrutiny of the scientific community can prevent expensive errors. In this respect the article is certainly valuable, since the readers constitute a large segment of the scientific community.

Albert M. Bottoms
Chicago, Ill.

The writer is Project Director of the Operations Research Task Force, Department of Police of the City of Chicago.
—Ed.

To the Editor:

The article, "Fighting Today's Crime with Yesterday's Technology" in the December issue of *Technology Review* has drawn attention to an area which we believe is vital to the effective functioning of our governmental system, the application of the advancements of science and technology to law enforcement.

The Municipal Police-Science Institute is a non-profit corporation whose membership is drawn from the business, scientific, industrial, educational, legal, and law enforcement professions. One of the basic functions of the Institute is to act as a medium to bring the advancements of modern technology and modern management to law enforcement through the sponsorship of research activities, demonstration projects and educational programs.

I hope that the article will interest your readers in taking part in the improvement of law enforcement, and will encourage them to take an active part in the improvement of their local law enforcement facilities, either individually or through participation in an organization such as the Institute.

John T. Howland
Boston, Mass. 02116

The writer is Executive Director of The Municipal Police-Science Institute, Inc.
—Ed.

To the Editor:

I read with interest the article by George Boehm entitled "Fighting Today's Crime with Yesterday's Technology," yet I must take exception to his statement that inferred that police administrators are "... hardly aware of what is happening ..." in the possible applications of science and technology to law enforcement.

The Boston Police Department is currently reaching the implementation stage of a program to establish an integrated information and communication system combining all the innovations mentioned in the article and several others not mentioned. In addition, the Department has undertaken several research projects

itself, and others in conjunction with various educational institutions. Especially fruitful and beneficial have been the Department's association with M.I.T.'s Operations Research Center and Urban Systems Laboratory.

It is the responsibility of all citizens to take an active part in law enforcement. Those citizens with specialized skills in highly technical areas can meet part of this responsibility by making their talents available to their local law enforcement agencies. I recommend that your readers contact their local law enforcement agencies, learn about their needs, and try to provide support and assistance to these agencies, both as citizens and as experts in their own fields. The Boston Police Department, along with many other departments, has been the beneficiary of the support, interest, talents, advice, and other resources of members of the scientific, educational, professional, and business communities who have done their civic duties by aiding in the advancement of this all-important function in our dynamic society. The Commissioner and Administration of the Boston Police Department welcome the interest of all sectors of the community in our operations and problems.

Steven D. Rosenberg
Boston, Mass.

Mr. Rosenberg is associated with The Bureau of Inspectional Services of the City of Boston Police Department.—Ed.

Chinese Brain Research

To the Editor:

The two lead articles in *Technology Review* for October/November on prospects for science in China were of particular interest to me in relation to recent Chinese work in brain research (selected papers of which I am translating for wider dissemination), for the Chinese-language *Acta Physiologica Sinica* and the *Acta Psychologica Sinica* were among the journals which apparently no longer appeared after about mid-1966.

Although it is understandable that new policies instigated in connection with the Cultural Revolution may result in a

"greater concentration of scientific effort on problems of direct relevance to China's development needs," as suggested by Mr. Oldham, it is certainly my hope that brain research is an area that is continuing or will be resumed, and thus be among those areas only temporarily eclipsed, as suggested by Professor Barnett. In my estimation, a prolonged de-emphasis of Chinese work in this area would be a distinct loss to science; moreover, the topic is one that is particularly suited for international scientific exchange.

John S. Barlow, M.D.
Boston, Mass.

"Simpering Manipulation"

To the Editor:

Let's hope M.I.T.'s task force to study the Institute's hiring of minority personnel (see *Technology Review* for December, pp. 92-93) does not follow *Technology Review's* lead and become a simpering attempt to manipulate numbers so that M.I.T. will "compare favorably with national figures." Considering the national figures, we wonder if any comparable figures could be favorable. (M.I.T. leads industry by 0.9 to 0.7 per cent in employment of black managerial personnel. So what?)

As for the goals of the task force: black people have been subjects of "deep concern" and "real progress" for 400 years. How about some action for a change? For example: are any of the 19 members of the task force from the minority groups the Institute hopes to reach?

Shan Woodward
Burns Woodward
New Haven, Conn.

To the Editor:

I hesitate to write concerning how to run M.I.T. because I feel that the Corporation and the administration are in a much stronger position to formulate policy. I am, however, disturbed that those who wish to solve the Negro's problem through a giveaway program or those who wish to socialize our society are so vocal that a reader could get the im-

pression that theirs was the only rational point of view.

I do not owe the Negro anything but equality. The Institute does not owe the Negro anything but equality. The Institute's criterion for dealing with students should be in terms of academic or professional excellence, not on the basis of race.

The socialist wants to solve so many problems all at once with someone else's money that he winds up solving no problems, destroying the money, and discouraging those who can produce money from working in that direction. Problems are not solved by employing vague, over-extended reasoning to link cause and effect.

The people who want to change university policy not through convincing the administration but through the use of force would just as soon see the university destroyed. They have nothing to lose, no investment. There are a lot of people who have something to lose if the university is destroyed. We have built M.I.T. as an educational and research institute. The Corporation and the administration have the legal and moral right to establish and execute policy. I think they need our support as much as a member of the family who is being attacked by thieves.

Richard Hardy
Huntsville, Ala.

Strobe Probe Answer (see page 71)

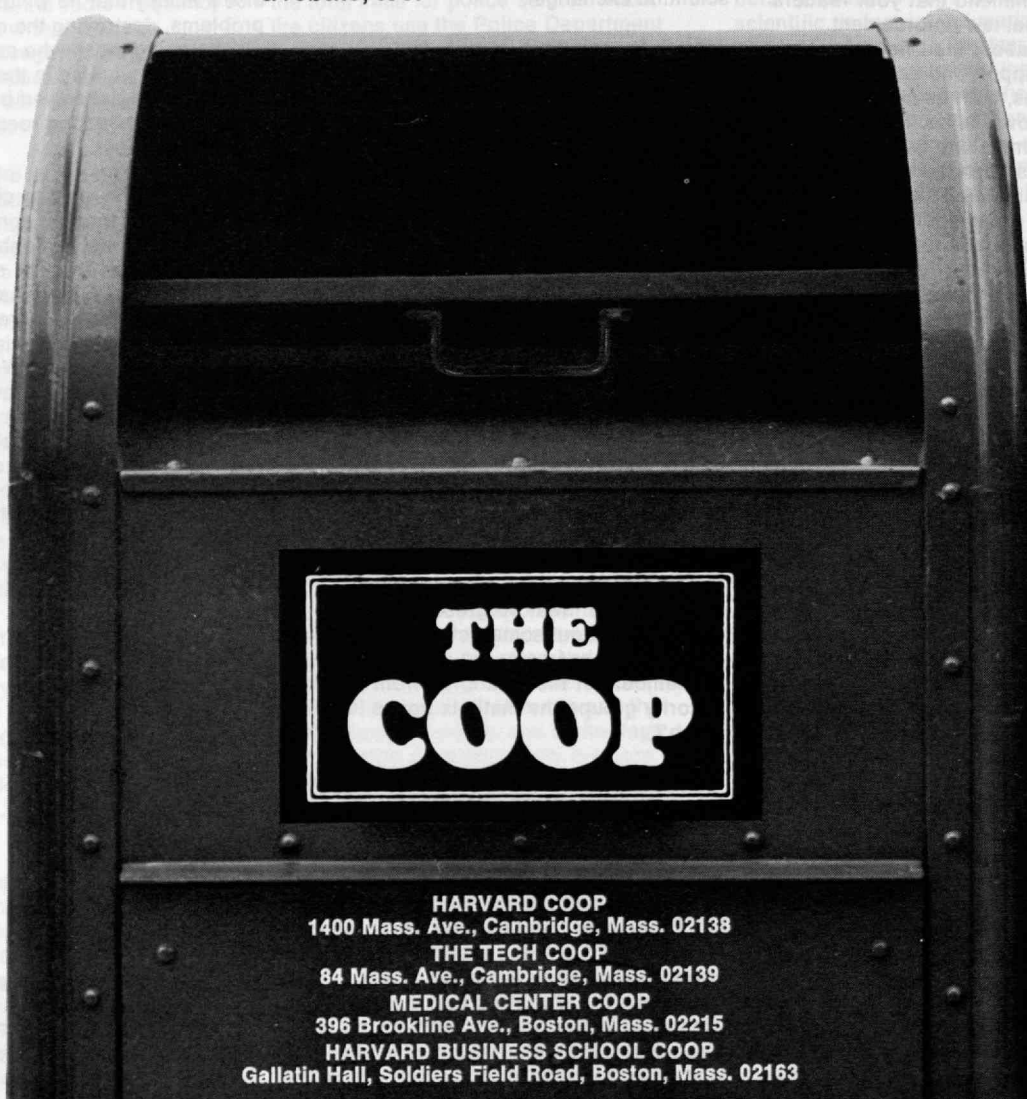
The larger bullet, traveling faster, tears the fabric of the balloon because of the higher pressure it creates inside.

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Evolution or Revolution in Admissions?

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Institute Review

Admitting Blacks to M.I.T.: A New Approach to Evaluation

James Williams, who will finish high school this June, wants to come to M.I.T. next fall. He has done well in high school, but not well enough—or his high school is just not good enough—to assure him admission to M.I.T.

But James Williams—a fictitious name—is black, and he, and perhaps 30 others, will be admitted with full-need scholarships to the M.I.T. Class of 1973 next fall. The Institute hopes there may be more like him in the Class of 1974, and still more in future years.

M.I.T.'s Conscience and the B.S.U.

Though the Institute quietly inaugurated Project Epsilon last year to help disadvantaged high school students "make the grade" in the Class of 1972, no one in Cambridge denies that James Williams' chances of coming here have been immensely improved by the activities of M.I.T.'s Black Student Union in 1968.

Out of prolonged and constructive discussions between B.S.U. and M.I.T. officials this fall has come "a radically different approach to evaluating applications from black students," says Roland B. Greeley, Director of Admissions. The essential difference, he says, is the acknowledgment "that their academic qualifications and especially their records on College Board tests will have been prejudiced by the blacks' lack of opportunity" in current American society.

Professor Greeley admits that as a result there may superficially seem to be two different admissions standards in the fall of 1969. But the real change, he thinks, is the realization at M.I.T. "that admissions and aid decisions have been made over the years on the basis of traditional measures of academic preparation, and we now admit that our insistence on certain rigorous selection criteria has not in the past fairly identified all those who can do the work at M.I.T. Now we simply say that to be fair we must apply a somewhat different set of standards" to black applicants.

Student aid will be different, too. All students coming to M.I.T. now have their

financial needs—as determined by a national College Scholarship Service questionnaire on personal and family resources and responsibilities—met in full, through scholarships and loans.

But beginning next fall, black applicants will receive financial aid on the basis of a somewhat different set of needs, to compensate for the somewhat different purchasing power of money in their hands; their financial aid will be provided entirely as scholarships—without loan funds—for their first and second years at the Institute; and when they do use loan funds, as third- and fourth-year students, a special review board will adjust their repayment schedules if they later take low-paying jobs serving the black community or if they have major family obligations.

To Identify Hidden Talent

It was early last fall when the B.S.U. first made its proposals to M.I.T.: to actively recruit for black students and to admit at least 100 black undergraduates each year; to recognize that blacks have been victims of discrimination in their educational programs by broadening the entrance standards and by providing special summer classes; to provide increased financial assistance and to meet that commitment entirely with scholarship funds; and to add blacks to the administrative staff in the admissions and financial aid offices.

Everyone at M.I.T.—administration and B.S.U. members alike—emphasizes that these proposals did not suggest any compromise of degree requirements; no one wants a "second route" to an M.I.T. degree. Both agree, too, in the concern expressed by Paul E. Gray, '54, Assistant Provost, that M.I.T. "not admit those whom we cannot engage, and who therefore cannot benefit from coming."

The issue, says Professor Gray, who is chairman of a special task force of faculty, administration and students to deal with M.I.T.'s fulfillment of these responsibilities, is "to expand M.I.T.'s opportunities, to find out how to identify young people with first-rate talent which has been hidden by second-rate schooling, to learn how to make exceptions when the chips are down."

To Tune in on Technology

Peter H. Richardson, '48, Associate Director of Admissions, says the task of increasing the number of blacks at M.I.T. is "formidable," and by far the greatest problem is simply to increase the number of applications. A U.S. Office of Education survey last spring reported that only 28 of M.I.T.'s 3,650 undergraduates were black, and the Admissions Office says only 30 applications were received from blacks for the Class of 1972. "The black community," Mr. Richardson told *The Tech* this fall, "is not yet tuned in on technology."

To help overcome this hazard, M.I.T. has provided financial support and its official auspices for 11 black students who each spent one week late in the fall visiting high schools and interviewing students. Returning to M.I.T., these interviewers, too, have agreed that their goals cannot be achieved overnight: they found high schools suspicious of their (and M.I.T.'s) motives and students uneasy about technological careers and about their ability to carry M.I.T.'s academic load, even at the reduced initial pace which the Institute proposes to make possible for them.

Assistant Admissions Director

John A. Mims, a member of the Chicago State College staff, has been named an Assistant Director of Admissions at M.I.T. Though he will participate in all phases of admissions work, Mr. Mims will play a key role in the Institute's effort to interest more Negro and minority group high school students in science-oriented higher education (see above), according to Howard W. Johnson, President of M.I.T., who announced the appointment.

One of Mr. Mims' first assignments, according to the announcement, will be to assist in reviewing applications from students contacted late in the fall by members of the M.I.T. Black Student Union.

Mr. Mims graduated from Chicago State College in 1966. In addition to his work as an administrative assistant in admissions there, he has been Co-Chairman of the Chicago Area College Assistance Project, an affiliation of over 30 colleges.

M.I.T. admissions officers explain how the Institute will fulfill its determination to make highest educational opportunities available to students whose ability is greater than is measured by their achievement.

Evolution or Revolution in Admissions?

Following is the text of a statement by William H. McTigue, '54, and William J. Hecht, '61, respectively Director and Executive Secretary of the M.I.T. Educational Council, prepared for the Institute's Educational Counselors.

Admissions is a vital step in the accomplishment of the mission of M.I.T. That mission may be described as responding to the needs of society for able, trained leaders, capable of assuming responsibility for its direction. In re-examining our admissions criteria prior to another round of admissions, many of us—administration, faculty, and students—were increasingly troubled by the degree to which our admissions criteria failed to reflect the needs of society.

This concern centers on our ability to select potential leaders in view of ever-widening differences in the levels of preparation of many of the high school population, and in view of our continued heavy reliance in the selection process upon College Entrance Examination scores as indicators of academic performance. We know that playing it safe brings us able students; we do not know how many more able people we are missing. We realized initially that M.I.T. cannot fulfill its role in training the leaders of society if it is not reaching our emerging minorities—such as black Americans. To accomplish the goal of providing much-needed leadership in this area, M.I.T. is now actively recruiting, as applicants for admission, black Americans and other minority group members. We will have a strengthened financial aid program for these students. We will take greater academic risks in their admission and rely substantially less on objective academic indices such as the College Board scores and much more on superior academic performance within their high school environment, even though the level of that performance may not equal that of the average M.I.T. applicant.

Since the admissions process first became "competitive," our aim has been to select the applicants with greatest potential. Over the past several years we have continued to rely heavily on the conventional indicators of academic

promise (school records and College Board test scores) but have assigned increasing weight to such non-academic qualities as personal force, creativity, initiative, and specially developed interests.

Three years ago the Admissions Office, as a specific experiment, admitted 18 students whose College Board scores were poor in comparison with our average admitted candidate but whose personal characteristics and school records seemed to indicate high ability in spite of their relatively poor preparation. Of this group, 12 accepted our offer of admission. Of the 12, 11 are still at M.I.T., with academic averages ranging from a high 4.8 to a low of 2.2; the twelfth struggled for four semesters but finally had to withdraw.

The results of this experiment, coupled with a strong desire to make our resources more available to disadvantaged students, led to Project Epsilon—the admission in the fall of 1968 of a group of nine such applicants (eight black Americans and one American Indian). Of the nine, six accepted admission and were offered an opportunity to spend the summer working and studying on the M.I.T. campus. Five students did spend the summer here. They took two courses, one in humanities and one in mathematics, as well as working part-time in various M.I.T. laboratories. It is too early to report on the results of the first Project Epsilon group; at least two—and probably four—semesters of experience are necessary before we can be sure whether they have really overcome their relatively weak schooling and problems of social adjustment.

This fall a task force comprised of faculty, administration, and M.I.T. Black Student Union members has undertaken a study of some of the problems associated with making the educational opportunities at M.I.T. open to more black students as well as to other economically, socially, and educationally disadvantaged groups. Three major conclusions have been forthcoming:

First, that we must do a more effective job of communicating about M.I.T. with this segment of our population (of the

4,000 applicants for admission in September, 1968, only 30 were black Americans). Several steps have been taken toward the accomplishment of this end. The Admissions Office has written directly to students who qualified for the National Achievement Scholarship Program, which is the black National Merit competition. Contact has also been initiated with 1,600 high schools having numerous black students to inform them of our opportunities. Eleven black M.I.T. students each spent one week this fall visiting high schools with a potential for supplying black applicants, and one of our American Indian students has conducted an extensive letter-writing campaign to interest other American Indians in M.I.T. and to ascertain what types of help are available to Indians who are interested in pursuing higher education.

Secondly, we realize a necessity to re-examine our financial aid system from the viewpoint of the culturally deprived student or family. Many may be unwilling to accept educational loans because of the great risk, real or imagined, involved in pursuit of an intangible objective which is poorly understood and scarcely, if at all, demonstrated in their own experience. This is not equivalent to the doctrinal resistance of some to debt in any form. It is rather a real fear based on ignorance of the facts: they have grave doubts whether they can succeed at M.I.T., whether first-rate education is worth the cost, and whether future earning power will be great enough to repay the cost.

Thus the concept of debt accrued for education is a real barrier in those cases, and we should remove it until the student has an opportunity to demonstrate conclusively that his risk of failure at M.I.T. is indeed small. Toward this end, the Institute will seek additional outside funds to enable us to offer to these students scholarship aid equal to full need during their first four semesters at M.I.T. Afterward, need would be met by our usual combination of loan and scholarship, in keeping with the insistence of all who have studied this problem that students in the upper years should be expected to maintain fully, and in all respects, the long-established M.I.T. standards.

(Continued on page 80)



Avery A. Ashdown, Ph.D. '24, Associate Professor of Organic Chemistry, Emeritus (right center), was among the proud hosts at an open house to display the remodeled entrances to Ashdown House, M.I.T.'s residence for graduate students. The House was named in his honor in 1965 after he retired following 29 years as Master of M.I.T.'s graduate residences. (Photo: Owen D. Franken, '68)

(Continued from page 79)

The third conclusion is that to attract a more diverse group of applicants we must be willing to admit many with some glaring indications of poor preparation, just as long as the balance of evidence suggests that they have the ability to succeed at M.I.T. Toward this end, we plan to have a separate selection process for applications who appear to come from disadvantaged backgrounds. This will be similar to the long-established separate selection processes by which we choose our foreign students and our female students. We will use the same methods but will examine more closely those applicants with relatively poor indices, especially College Board scores, who seem to suffer from inadequate preparation rather than a lack of ability. Clearly, we do not want to admit students with slight chance of success at M.I.T., but we will accept greater academic risks with students who indicate unusual potential to cope with our environment, even though they may not have been able to prove it with high test scores. We will continue to insist on their demonstrated ability to do outstanding work in their schools, their potential to weather problems of social adjustment, and their apparent desire to overcome inadequate preparation. Those students admitted will be offered additional tutoring, including participation in a pre-freshman summer program, if necessary.

One further note: It must be clearly stated that we are not establishing a second route through M.I.T. nor establishing a segregated black M.I.T. within the Institute, and we will demand the same level of performance at M.I.T. once these students make the adjustment, probably before or by their junior year, as we demand of their peers. Deficiencies in preparation can and must be accommodated, but the high caliber of M.I.T. graduates will be maintained. We do feel that these definite steps must be taken to assure that the resources of M.I.T. will be available to more students whose social, economic, or educational deprivation has kept their standard measures of achievement below their ability—an ability to cope with an M.I.T. education, apply it professionally, and add much-needed leadership to the emerging groups within our society.

Ashdown Metamorphosis

When the Riverbank Hotel was built at the corner of Memorial Drive and Massachusetts Avenue in Cambridge more than 60 years ago, the plan included a drive-through courtyard where residents could alight from their carriages within the protection of the building.

But times changed, and what was a gracious courtyard for an apartment hotel became a drafty and unappealing lobby for a graduate student residence hall.

Now there has been another metamorphosis, and Ashdown House residents come and go through a glassed-in entry which is both warm and dignified. A central desk in the middle dispenses mail, keys, and periodicals; and the loading platform on the Amherst Street side has been replaced by a landscaped courtyard entry.

Wiesner to Direct Information Services

Dr. Jerome B. Wiesner, Provost of the Institute, is taking charge of policy level guidance for the Institute's information processing services, Howard W. Johnson, President of the Institute, has announced. He will act as chairman of two new committees which will help policy guidance and replace the former Information Processing Committee.

The two new committees, Mr. Johnson said, will be an Information Processing Board and an Information Processing Services Committee. The Services Committee will serve in an advisory capacity to Richard G. Mills, '54, Director of Information Processing Services, who will report to Dr. Wiesner. Mr. Mills will continue to have responsibility for the operations of the Information Processing Center at M.I.T. and for the development of the total Institute plan for computation services. The Information Processing Board will advise the Provost directly.

Compton Professor of Physics

Francis E. Low, whom Robert A. Albery, Dean of the M.I.T. School of Science, describes as "one of our most distin-

guished theoretical physicists," has been appointed Karl Taylor Compton Professor of Physics.

Professor Low, who is considered a leading authority on elementary particle physics, was graduated from Harvard College in 1942 and holds M.S. and Ph.D. (1949) degrees from Columbia University. Before joining the M.I.T. faculty in 1956 he had been a member of the Institute for Advanced Study at Princeton for two years and at the University of Illinois for four years.

Professor Low has written a number of fundamental papers on nuclear and electromagnetic forces, and since its opening in 1968, he has been a leader of the M.I.T. Center for Theoretical Physics. He is also a member of the Executive Committee for the Cambridge Electron Accelerator.

Individuals Noteworthy

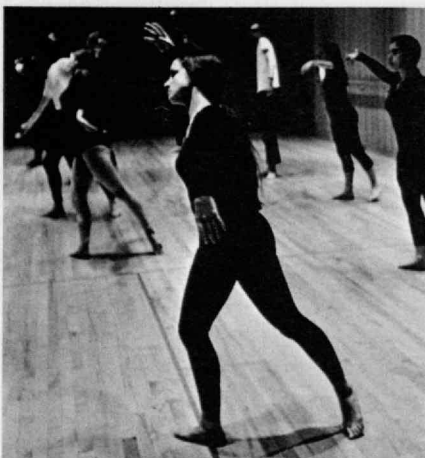
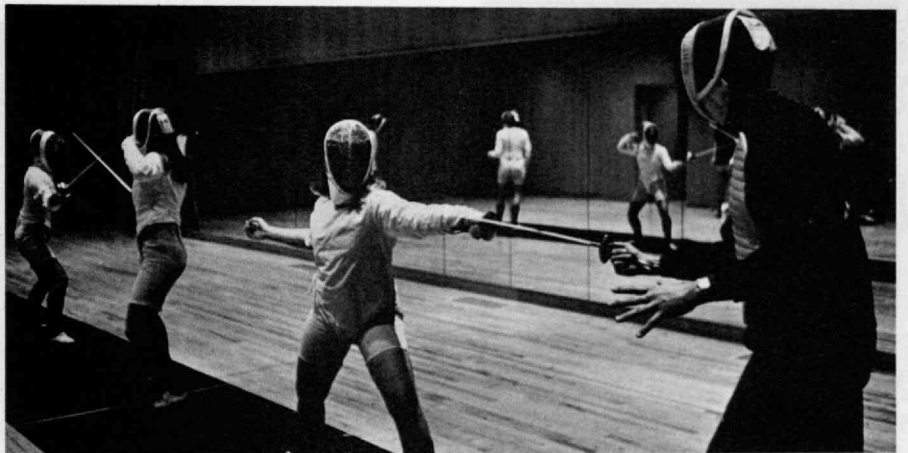
Francis W. Sargent, '39, has been catapulted into the Governorship of the Commonwealth of Massachusetts by the resignation of John A. Volpe to be Secretary of Transportation in the Nixon Administration. Governor Sargent had served as Commissioner of Natural Resources prior to his election as Lieutenant Governor in 1966.

A second Governor: Luis A. Ferré, '24, was the successful candidate for the Governorship of Puerto Rico. His inauguration was attended by Howard W. Johnson, President of M.I.T., and James R. Killian, Jr., '26, Chairman of the Corporation, among other dignitaries (see p. 91).

Athelstan F. Spilhaus, S.M.'33, named President-Elect of the American Association for the Advancement of Science, to serve as President in 1969-70. . . Irwin W. Sizer, Dean of the M.I.T. Graduate School, to the Board of Governors of Rutgers—the State University.

To Murray Gell-Mann, Ph.D.'51, the 1968 Research Corporation Award of \$10,000 "for notable contributions to knowledge" as a member of the Division of Physics, Mathematics and Astronomy at California Institute of Technology.

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The Distaff Side

Co-eds we're getting used to—and this year even in athletics. The girls are registered for physical education classes in at least 11 sports, including skiing and skating; they have organized inter-collegiate competition in fencing, sailing, and rowing; and their enthusiasm has had special impact on modern dance classes in McCormick Hall gymnasium. (Photos: Jeffrey M. Reynolds, '69)

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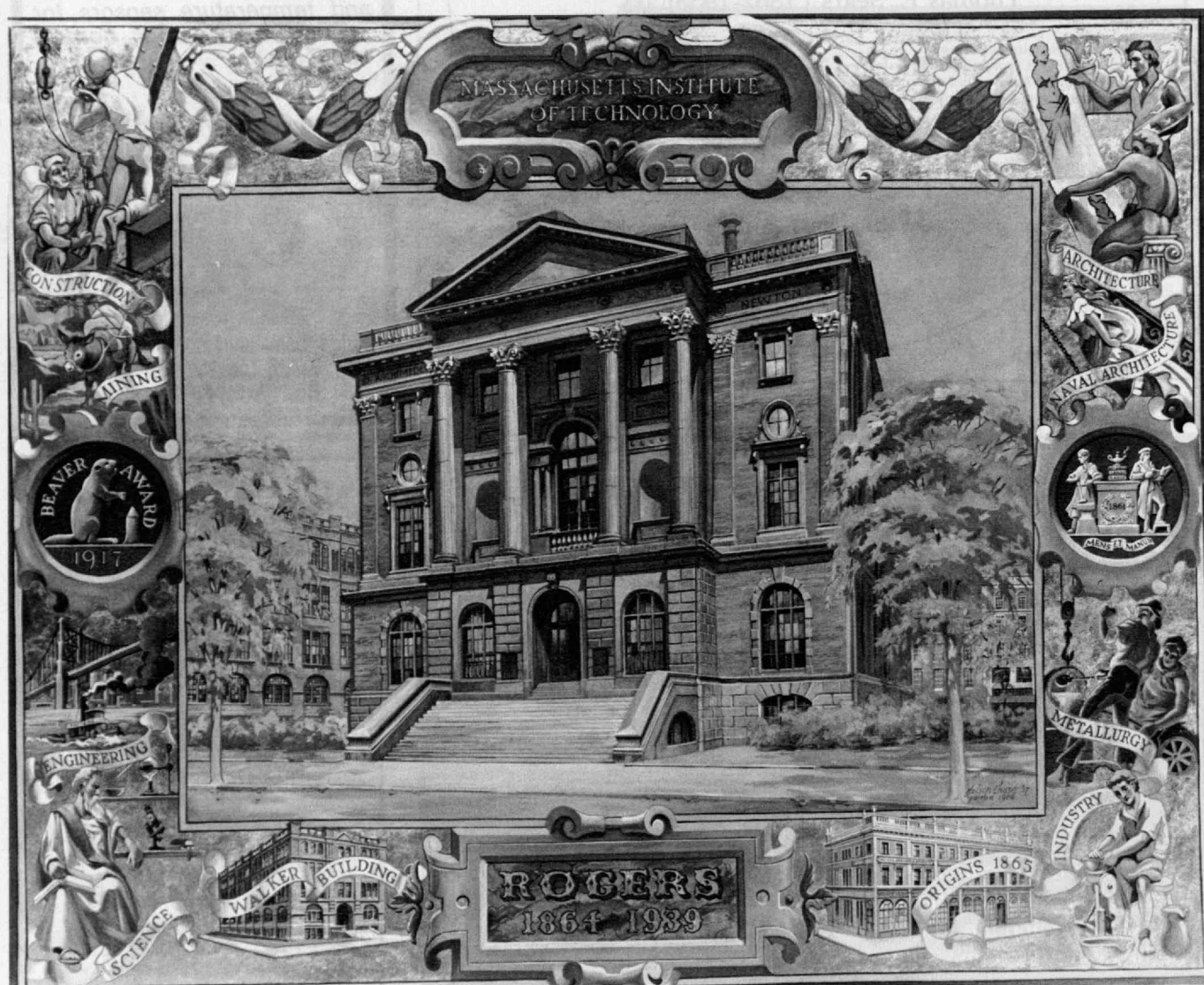
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Alumni News



Nelson Chase, '17, painted this rendering of the Rogers Building, M.I.T.'s first home, upon the commission of widows of members of the Class of 1917, who presented it to the Institute on Alumni Day, 1968. The painting now hangs in the M.I.T. President's Office; it is the first gift to the Institute underwritten collectively by the widows of an M.I.T. class, and John A. Lunn, '17, President of the Class, hopes it will be "the inspiration for many more." (Photo: Fay Photo Service)

The Class of 1917: Rogers Building on Canvas

A new precedent was set in 1968 by widows of members of the M.I.T. Class of 1917 when they joined to underwrite, commission and present to the Institute a painting of M.I.T.'s first home, the beloved Rogers Building on Boylston Street in Boston. The painting, by Nelson Chase, himself a member of the Class of 1917, now adorns the M.I.T. President's Office.

Mr. Chase's work, in full color, measures 9 by 7½ feet; the delineation of the building is surrounded by a border which reproduces some of the frieze around Huntington Hall, the great assembly hall of the building.

The building itself was completed in 1866 to the plans of the Institute's founder, William Barton Rogers, and was used by the Institute until 1938 when the School of Architecture finally moved to Cambridge. Then the Rogers Building was torn down to make way for the New England Mutual Life Insurance Company's new home office; but its "twin," built for the Boston Museum of Natural History, stands on adjacent property as the Boston store of Bonwit Teller.

The Rogers Building, synonymous with the history of "Boston Tech," remained at the heart of M.I.T. as the institution expanded from 1866 until 1916, when most departments moved to Cambridge. Its "Rogers Steps" became a famous gathering place, its Huntington Hall at the head of the steps was M.I.T.'s largest meeting room.

Technology Review: Ruth King Retires; Wheeler and Thomas Appointed

Three changes effective on January 1, 1969, have been announced at *Technology Review*: Ruth King, Associate Editor of the *Review*, has retired after 42 years of service at M.I.T., 40 of them as a member of the *Technology Review* staff. Frederic F. Wheeler, formerly Technology Editor of the respected British journal *New Scientist*, has joined the *Review* as Acting Managing Editor; and Lynn H. Thomas, formerly Assistant Editor of the *Bulletin of the American Academy of Arts and Sciences*, has been named Associate Editor of the *Review*.

Miss King's association with *Technology Review* began in 1929, three years after she came to M.I.T. as secretary to Orville B. Denison, '11, Secretary of the Alumni Association. She served as secretary to Ralph T. Jope, '28, Business Manager, and as a member of the business staff until 1946, when she became secretary to Beverly Dudley, Editor and a member of the editorial staff. Miss King became Assistant to the Editor in November, 1962, and Associate Editor of the *Review* in February, 1966. A native of Somerville, Miss King studied at Somerville High School and at the Boston University College of Practical Arts. Her retirement plans include part-time work in Lexington, Mass., where she makes her home.

Mr. Wheeler, a physics graduate of Imperial College, London, in 1959, was associated with *New Scientist* after 1963, when he joined the magazine as a staff writer; he became Technology Editor in the summer of 1967. Previously he had served in the British Army and as a member of the staff of *Nuclear Engineering Abstracts*, and he is the author of books and papers of specialized interest.

A native of Philadelphia, Miss Thomas studied at Bryn Mawr and later did special work at Radcliffe; she was Production Manager and later Figure Skating Editor of *Skating Magazine*, the official publication of the U.S. Figure Skating Association, before joining the American Academy of Arts and Sciences.

Alumni Fund: 10 and 21 Per Cent Ahead

A first report from the Alumni Fund Board, presented by Howard L. Richardson, '31, Chairman of the Alumni Fund Board, to members of the Alumni Advisory Council late in November, showed significant increases in the number and amount of giving to the 1969 Alumni Fund. By November 21 more than 6,000 donors—a 10 per cent increase over the same date a year ago—had been given to the Fund, Mr. Richardson said, and total gifts were \$561,057, twenty-one per cent more than a year ago.

The Fund is proceeding with the appointment of Course Agents to present M.I.T.'s interests to alumni who hold graduate degrees only from the Institute, and Mr. Richardson listed ten such agents who had been appointed by November 20: Harold E. Dreyer, Ph.D.'52, economics; Karl L. Fetters, Sc.D.'40, metallurgy; Kenneth G. Fettig, S.M.'53, civil engineering; Morton I. Goldman, Sc.D.'60, nuclear engineering; John H. Halford, S.M.'40, management; Howard O. McMahon, Ph.D.'41, chemistry; E. Leigh Secrest, Ph.D.'51, physics; Donald L. Thomsen, Jr., Ph.D.'47, mathematics; Ronald C. Wornick, S.M.'60, nutrition and food science; and William M. Zarkowsky, S.M.'58, Sloan Fellow.

Alumni Advisory Council: Airport and Seaport—\$400 Million

When 35 students set out to redevelop Boston's airport and seaport facilities, they ask lots of questions: Does Boston need a seaport at all? Do we need a bigger airport, and if not now, when? What should be the financial management of such transportation facilities? How do labor unions affect such development? What are the alternatives for new airport location? Socio-political implications of these decisions?

The process—and the answers to which it led—were described for members of the Alumni Advisory Council at their November meeting by William W. Seifert, Sc.D., Professor of Electrical Engineering. His subject was Project Bosphorus, an interdisciplinary study assigned to a group of M.I.T. undergraduates and graduate students in the spring term of

Boston Harbor as it might be, with an Outer Islands airport and a Logan ship terminal.



1968. The students used a computer simulation to project air transportation demand in the Greater Boston area for the next 20 years, then studied four possible airport sites on the basis of cost, distance, and displacement of population. The choice was Brewster Island, in the Outer Harbor—which led to the design of a Brewster Island airport and an access bridge from Logan Airport.

Meanwhile, said Dr. Seifert, other students were studying the problems and potential of Boston as a seaport. They concluded, he said, that to be competitive with other East Coast ports Boston must reduce its cargo handling costs by \$10 to \$15 a ton—and for a real competitive advantage costs must come down by \$20 a ton. The students' conclusion was that new fully automated port facilities on the present site of Logan Airport would make this possible. Hence the students' final recommendations: establish a new Massachusetts Department of Transportation to coordinate and operate a Massachusetts Port Commission and a non-profit Port Administration Corporation; plan for a new outer harbor airport, and develop new port facilities to replace the airport at Logan. The cost? About \$400 million, said the students without batting an eye.

Alumni Calendar

Baltimore—February 6, Thursday, 6:30 p.m.—Dinner Meeting, Engineers Club. Speaker: Hon. Robert C. Embry, Jr., Commissioner of Baltimore Housing and Community Development. "Housing and Community Development."

Boston—March 13, Thursday, 12:00 noon—Luncheon Meeting, Union Oyster House, 41 Union St. Speaker: James M. Austin, '41, Professor, Director of the Summer Session. Subject: "Air Pollution."

Buffalo—March 13, Thursday, 6:00 p.m.—Dinner Meeting, Lord Amherst Restaurant, Snyder. Speaker: I. A. Hockstra, Erie County Director of Pollution Control.

Cape Kennedy—March 6, Wednesday, 12:00 noon—Luncheon Meeting, Ramada Inn.

Chicago—February 7, Friday, 6:30 p.m.—Theatre-dinner Party, Ivanhoe Restaurant.

Fairfield County—February 18, Tuesday, 6:15 p.m.—Dinner Meeting, Clambox (in Westport). Speaker: Charles E. Kendall, Vice President of Franklin National Bank. Subject: "Venture Capital Sources for Small Business."

Hartford—February 7, Friday, 6:00 p.m.—Joint Dinner Meeting, Wellesley and M.I.T. Clubs. Subject: The Cross Registration Program between M.I.T. and Wellesley.

Houston—February 8, Saturday, 6:00 p.m.—Joint Dinner Meeting, Engineers Club, Wellesley and M.I.T. Clubs. Subject: The Cross Registration Program between M.I.T. and Wellesley.

Houston—March 2, Sunday—Joint Harvard Business School and M.I.T. Club Meeting. Speaker: Professor Arnold E. Amstutz. Subject: "Computerized Investment Approach to the Stock Market."

London, England—February 4, Tuesday—Dinner meeting (time and place to be announced). Speaker: Dean William F. Pounds, Professor of Management, Sloan School. "New Opportunities in Management."

Long Island—March 15, Saturday, 10:00 a.m.—Eastern Regional Alumni Conference, Garden City Hotel. Speakers: James R. Killian, Jr., Chairman, M.I.T. Corporation; The Honorable Robert C. Wood, Secretary, Department of Housing and Urban Development; Patrick M. Hurley, professor of geophysics; Secor D. Brown, professor of air transportation; Nevin S. Scrimshaw, Head, Department of Nutrition and Food Science; Robert A. Alberty, Dean, School of Science; and others.

Mexico City—March 13-15—21st Annual Fiesta, M.I.T. Club of Mexico. Contact M.I.T. Club of Mexico City, Reforma 116-804, Mexico 6, D.F. Mexico.

Miami—February 20, Thursday—Joint M.I.T. Wellesley Club Meeting. Guided tour of the Viscaya Palace, 5:30 p.m. Cocktail and Dinner Meeting at the

Viscaya Palace, 6:30 p.m. Speaker: Ruth M. Adams, President, Wellesley College. Subject: "Students and Societies."

Milwaukee—February 7, Friday, 7:00 p.m.—Joint Meeting, M.I.T. and Wellesley Clubs. Dinner and fashion show, Gimble-Schusters. Theme: "An Evening in Boston."

New York—February 20, Thursday, 12:00 noon—Luncheon Meeting, Park 100 Restaurant. Speaker: Marcel Breuer. Subject: "Concrete and Architectural Form."

New York—March 13-14, Thursday and Friday, 9:00 a.m. to 4:00 p.m.—Seminar, (\$30.00 for members, \$40 for non-members; lunches included), IBM Office Building. "Computers for the Uninitiated."

St. Louis—April 12, Saturday—Western Regional Alumni Conference. Sponsored by the M.I.T. Club of St. Louis.

Seattle—February 4, Tuesday, 6:30 p.m.—Annual Dinner Meeting, Gasperetti's Roma Cafe. Speaker: Dr. Curtis C. Johnson, Assistant Director, Bioengineering Division, University Hospital. "Recent Advances in the Field of Bioengineering."

Washington, D.C.—February 11, Tuesday, 6:00 p.m.—Joint M.I.T., Wellesley Club Meeting, Sheraton Hotel. Speaker: Charles P. Kindleberger, Professor of Economics, M.I.T. Subject: "Economics and Foreign Trade." Marshall I. Goldman, Professor of Economics, Wellesley College is also speaking. Subject: "Soviet Economics."

Class Reunions—June 14-15, 1969

Alumni Day—June 16, 1969

Alumni who travel are invited to attend these Alumni Club programs.



M.I.T. Club of Virginia: Recruiting for M.I.T.

Over 1,200 students, teachers, and parents came to Richmond's Mosque November 1, 1968, to hear Philip Morrison, Professor of physics at M.I.T., talk on Supernovae: Exploding Stars.

Our galaxy has not had such an explosion since 1604 when Johannes Kepler observed a supernova with the unaided eye and recorded its details. Since the invention of the telescope, however, about 200 supernovae have been observed in other galaxies. After a brief introduction by Donald L. Brown, '51, Richmond Club President, Professor Morrison described this rare astronomical event. The lecture, sponsored by the Richmond Public Schools' Math-Science Center, was suggested by Carson Brooks, '35, Richmond Educational Council Chairman, who felt such a lecture to be an effective way of making local high school students aware of M.I.T. Arrangements for Professor Morrison's appearance were made by William McTigue, Director of the Educational Council.

Deceased

Edward A. Porter, '93, November 25, 1967
Conrad Loring, '99, November 14, 1968
Elbert G. Allen, '00, October 3, 1968
Frederick W. Chandler, '06, October 20, 1968
Charles A. Holmquist, '06, September 27, 1968*
Roger L. Rice, '06, November 22, 1968
Arthur L. Sherman, '06, December 5, 1968
Carl E. Hollender, '08, October 25, 1968
Warner H. Kiefaber, '08, November 16, 1965
Hugo F. Kuehne, '08, November 26, 1963
Edward J. Scott, '08, May, 1966
Allen T. Weeks, '08, January 7, 1968
V. Carl Grubnau, '09, November 5, 1968
James K. Campbell, '11, October 19, 1968
Joseph Gershberg, '11, November 14, 1968
Lloyd A. Patrick, '11, December 28, 1967
Armand H. Peycke, '11, October 10, 1968
Theodore F. Kalbfleisch, Jr., '12, November 18, 1968
Arthur J. Lennon, '12, June 27, 1959
R. Howard Annin, '14, September 4, 1968
Dr. Mark F. Boyd, '14, May 31, 1968

George W. Donovan, '17, November 17
Willard B. Newell, '17, October 25, 1968*
Ralph H. Sawyer, '17, November 8, 1968*
Norman Dawson, '18, November 1, 1968
Alfred A. Johns, '19, June 1, 1968
Charles W. Eaton, '20, July 18, 1968
Winfred C. Wilde, '20, October 30, 1968
William Aronoff, '21, September 26, 1968
Charles F. Baish, '21, August 28, 1968
Donald D. James, '21, September 14
Francis J. Magee, '21, August 7, 1968
Archie L. Mock, '21, October 29, 1968
Harding de C. Williams, '21, November 2, 1968
Walter G. Chick, '22, November, 1968
Alexander D. Ross, '22, November 13, 1968
Richard P. Schonland, '22, June 28, 1968
Ruth A. Thomas, '22, April 3, 1968
George H. Towne, '22, June 28, 1962
George A. Watt, '22, October 9, 1968
Cyrus L. Day, '23, July 5, 1968
George A. Ballentine, '24, March 21, 1968
Phillip A. Herrick, '24, October 16, 1968
Bengt R. F. Kjellgren, '24, November 10, 1968
George M. McIlveen, '24, October 23, 1968
Emerson J. Van Patten, '24, June 21, 1968
Mrs. Gerald R. Barrett, '26, September 23, 1968
Louis H. Waters, '26, December 22, 1967
George W. Jacobs, '27, July 29, 1968
Harold F. Dean, '29, August 2, 1968
Clarence C. T. Loo, '29, May 26, 1968
Selwyn H. Towne, Jr., '29, September 24, 1968*
John H. Rogers, '30, August 4, 1968*
David Q. Wells, '30, September 30, 1968*
Joel H. Hirsch, '32, November 24, 1968
John L. Person, '32, October 3, 1968
Nathaniel Saltonstall, '32, November 13, 1968*
William H. F. Carberry, Jr., '33, May 17, 1968
Harold N. Logan, '35, August 1, 1968
Edward H. McCann, '38, July 31, 1968
Frediano D. Mattioli, '42, April 9, 1967
Robert S. Faurot, '44, October 19, 1968
Robert D. Seymour, '44, January 27, 1968
Reynold M. Bisconer, '49, August 5, 1968
Reverend James T. Kerr, '50, October 12, 1964
Daniel L. McDermott, Jr., '57, September 12, 1968
Alfred A. Purvis, '60, November 7, 1967
David L. Wright, '67
*Further information in Class Review

When Mr. and Mrs. Lawrence B. Barnard ('31) set their holiday table in Wellesley Hills, Mass., for Thanksgiving this winter, they were preparing for an M.I.T. family event. The guests included Michael D. Curd, '69, Mr. Barnard, John D. Barnard, '63, H. Neal Carr, '34, Richard A. Stokes, '71, David A. Erickson, '70, and Steven M. Chamberlain, '70; all except Mr. Carr (Kappa Sigma) are members or alumni of the M.I.T. Chapter of Phi Gamma Delta Fraternity. (Photos: David A. Erickson, '70)

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CONFRONTATION



On December 17 last, a Letter to the Editor from Alex Makowski '72 appeared in The Tech, allegedly reporting a conversation he overheard between the "Dean of Student Admissions" and a Miss Jenkins, woman student.



Why, come in Miss Jenkins. What may I do for you?

As you know, Dean, I represent the Women Students Union. We've been investigating the situation here at Tech, and we've uncovered some rather discouraging statistics. Did you know that, whereas 51% of this nation's population is female, the ratio of girls here is only about 5%? WSU has drawn up a list of demands, steps which we expect the administration to pursue to rectify this tragic and morally reprehensible situation.

But Miss Jenkins, this is a scientifically oriented school. You can't expect us to accept the proper ratio of girls.


Do you dare to suggest that the female sex is inferior?

Of course not. I'm only saying that, because of the way our society is structured, most girls do not receive a strong enough scientific education to successfully compete with boys for admission.


Dean, I didn't come here to listen to a lot of excuses. Our demands can be summed up by two main proposals: to be certain that girls have every chance of applying, we want a more comprehensive program of recruitment and financial aid to potential women students, and to guarantee true equality, we want 51% of next year's freshman class to be women.

I can agree with the principal behind your first demand. Women students should be given every opportunity to attend our Institute. But your second demand is morally unjust; it amounts to prejudice. If we have trouble meeting your quota because few girls are applying, we would be forced to accept students who may possess no other qualification than the gender of their sex. Should I be considering two people for admission, one boy and one girl, I could be compelled to decide in favor of the girl, even though the boy might be far more qualified and far more likely to succeed. Don't you find that "morally reprehensible"? After all, neither that boy nor this Institute is responsible for any of society's prejudices. Why should we atone for them?

I said I wouldn't hear any doubletalk. This is a black and white issue; there are no shades of gray. You either meet our demands or suffer the consequences.



Sound like a far-fetched bit of satire? Then read this from an address delivered to the AAAS in Dallas on December 29, (almost two weeks after Makowski's letter), by Dr. Elizabeth Hay, Harvard Medical School professor. "...women outnumber men in this country by 3 million, but only 5% of our physicians are women...not more than 2 or 3% of truly successful research scientists are women...speak out publicly...help end prejudice against women becoming doctors and scientists...women are the most underprivileged of America's oppressed groups."



Seer Makowski wrote better than he knew!

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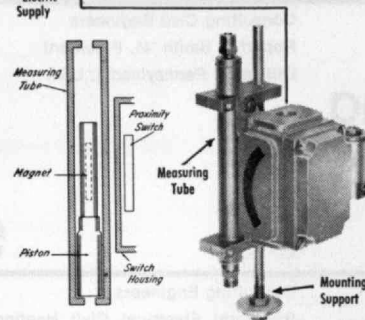
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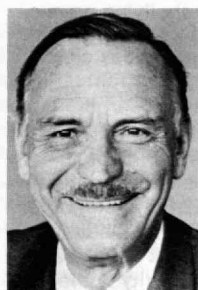
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Class Review

late news

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Luis A. Ferré, '24

The following is quoted from the New York Times of January 3 (see also Class of '24).

"SAN JUAN, P.R., Jan. 2—Luis A. Ferré pledged 'La nueva vida,' a new life, for 'the thousands of destitute Puerto Ricans,' at his inauguration today as Governor of this tropical island.

"The ceremonies, on the steps of the sun-swept Capitol Building overlooking an emerald sea, ended the 28-year-reign of the Popular Democratic party of Luis Muñoz Marín and Mr. Marín's successor as Governor, Roberto Sánchez Vilella.

" 'For the first time in Puerto Rico executive power is transferred from an outgoing Governor to the elected Governor of an opposing party,' Mr. Ferré, a 69-year-old industrialist, told the crowd. 'Today we see a peaceful and orderly change of power.' "

of note

See photo and story

Brother's 100th birthday

Still going strong

Do you remember (see photos)

He sleeps on the tool chest

Transplantation
It would be horrible

Painting presented (see photo)

Letters from the 2 "Petes"

Timothy Shea

First prize

In the news

Elected governor

The local color of Pigeon Cove

Receives Wetherill Medal
Conrad award

Womanpower

It's in the family

Federal funds and the university

Darkley Wise and Rudely Great

Deepsea Ventures

Class constitution proposed
Doing his "thing"

A new hotel for Harlem

The Mutants

Copy for this issue of *Technology Review* was due from your Secretary about December 10. Information reaching him after that date will be reported in the March issue unless he desires to insert it in the Late News column.

95

A telephone conversation with *Luther Conant* found him in good health but feeling he was the forgotten man. How about letting him know he is *not* forgotten? His address: Prospect Gordon Convalescent Home, Prospect Avenue, Norwalk, Conn.—*Andrew D. Fuller*, Secretary, 1284 Beacon Street, Brookline, Mass. 02146

98

What an interesting life *Lyman F. Hewins* must have! He lives aboard his houseboat, Nenemoosha, c/o Clayton Marina, Ridge, Md. 20680. He wrote, "I was in hopes of making the 70th Reunion at M.I.T. but gave it up owing to general weakness. I have no organic trouble but am just about out of gas! I manage to keep afloat in my fifty-foot houseboat (I was in it 1963) but don't get ashore very often—barber shop visitor about once in six weeks. Regards to Classmates; was in hopes *Lacy* would run down from Baltimore. Maybe he would if asked. I am under care and supervision alternately of Mrs. Spencer Hewins (my daughter-in-law) and my daughter, Mrs. R. E. Gallagher. Spent five months at Bahia-Mar-Marina, Fort Lauderdale, Florida last winter. Have made Orleans, Mass. six summers out of the eight that I have owned this boat. Please see picture of my shipmate, 'Cookie', who pulls out her breastfeathers if permitted; hence the bib." (See photo next page.)

Isn't that a fine picture? The Captain and shipmate appear to be most congenial. By the way, did you see my picture on page 118 of the December *Review*?—*Mrs. Audrey Jones Jones*, Acting Secretary, 232 Fountain Street, Springfield, Mass. 01108

03

Well, classmates, the year 1968 with its enjoyable Xmas and New Year celebrations is now a memory. For we gay old spirits, although now serenely settled so distant and apart, class news is ever an uppermost interest. As you may be aware, our secretarial assignment is at

Lyman F. Hewins and "Cookie" aboard the houseboat *Nenemoosha*. See Class of '98, previous page, for the story.



times a mathematical problem of extreme magnitude and accompanying duress. May I at this opportune period for new admonitions arouse in each of you an earnest desire to cooperate with some news for our cherished column, no matter how brief, as it brings our classmates to the forefront for all to enjoy.

A very cheering note was received from *Clarence M. Joyce* who would appreciate a call from any of our classmates when in New York City; to address him by mail: 91 Beach Street, Kearny, N.J., or phone him at 201 744-5182.

Brother's 100th birthday

An unusual note from our devoted Counselor; *Ichabod F. Atwood* had news that his brother, Alton B., a local philanthropist, retired business leader and an active member in many Chelsea, Mass., organizations, was celebrating his 100th birthday on October 17. At his banquet, held at the Salem Country Club, messages were read from the County Road Church, Chelsea Rotary Club, most of the Chelsea banks, the York and Scottish Rites Masons and Aleppo Temple Shrine. Special letters came from President Johnson, Senator Kennedy, Governor Volpe and Mayor Slater of Chelsea.

An artistic Xmas card with a letter arrived from Mrs. Florence Gould, who ever carries on the loyalty of Roy, our former class secretary. She is grateful for her good health and actively enjoys the frequent visits and endearing hospitality of her children and grandchildren. Two of her grandsons entered college this fall. Two grandchildren are already juniors in college with one grandson in military service. We one and all wish her the continued blessing of merry Christmases and happy new years.—*John J. A. Nolan*, Secretary, 13 Linden Avenue, Somerville, Mass. 02143

04

We have received little news since our last report. *Harry H. Needham* has a new address: Apartment 6L, 40 Washington Street, E. Orange, N.J. 07017.

Word has been received of the death of *Calvin R. Sheate*, in Apopka, Fla.

I neglected to wish you all a Merry Christmas, so I'll now wish you a Happy New Year and continued good health and fortune for the rest of 1969.—*E. H. Russell, Jr.*, Acting Secretary, 82 Stevens Road, Needham, Mass. 02192

05

Why no notes in the last issue? Same answer, but due to the class spirit and energy of *George W. C. Whiting*, we have enough for a short column today. Because his letter is so interesting, I am quoting several sections of it.

Still going strong

"As you know I am partially blind but I manage to be still active in the Contracting Business that LeBaron Turner and myself organized in 1909. I bought LeBaron's interest in 1925 and since then have conducted the business on my own.

"I serve as Chairman of the Board and last year the company was in the top half of the four hundred largest contractors in the United States. We have our main office in Baltimore with branch offices in Memphis, Tenn.; Atlanta, Ga.; Washington, D.C. and in the new City of Columbia in Maryland.

"In the years that have passed there is practically no branch of construction that has not claimed our interest and efforts. For many years we were heavy construction contractors building bridges, dams, tunnels, deep and difficult foundations, railroad construction and waterfront work. Today most of our work is on high rise apartments, commercial and industrial buildings and some bridge work. We are fortunate to number among the most of our clients some of the largest industrial concerns in the country for most of whom we do a large amount of repeat work.

"My original interest was construction and I still find it no effort to maintain my continued interest and enthusiasm after fifty-nine years. I have every reason to believe that this will continue until my final papers are signed.

"I note your remark that only six are left from our classmates. You did not say who they are, but I send my regards to all six. Thank you very much for keeping in touch with me." There is one mistake here—mine. I, of course, meant "course-mates." There are still six living members of Course I, out of a total of forty-two who graduated with us.

Under oath

Recently I talked with *Doc Lewis* on a chemical problem. I am still dabbling, mostly without fee, on a water-conditioning problem of one of my neighbors. I had to commit myself on a matter, which I might have to back under oath, so I went to the best authority in the U.S.A. on chemical engineering and got the answer I wanted. Doc had seen Hub and Helen recently and stated they were ambling along pretty well. Hub still goes to the office most every day which is pretty good ambling for our age, I think.

More letters

Arthur E. Russell tells us he has moved from Miami Beach where he has been living for two years, to a very congenial retirement home in Miami where he enjoys the companionship of seventy guests. Please send your new address, Arthur.

A letter from *Bob Adams* says, "I can still keep my accounts and attend to my investments. I recently completed a large sub-division, which is selling very well." So here's another ought-fiver working. Probably a sub-division would be huge around here. It's too late to wish you a Merry Christmas or a Happy New Year, but I can wish you, all forty-two, a very healthy and comfortable 1969.—*Fred W. Goldthwait*, Secretary, Box 32, Center Sandwich, N.H. 03227

06

Among my treasured archives is the printed program of the annual dinner of the Alumni Association on January 7, 1928, at the Boston Chamber of Commerce. The program was signed by nine men of whom five are still around—*Abbott (W. G.)*, *Ball*, *Bellamy*, *Davol* and *Rowe*. Sam Prescott presided at that



The two photos to the left show the preparations for one of the Nantasket Beach activities at the 1916 all Technology Reunion which celebrated the dedication of the new buildings in Cambridge. What are they up to? See Class of '12, below.

meeting and of the 15 at the head table three were speakers—President Stratton, Dr. Frank Jewett, and the Honorable Dwight Davis, then Secretary of War. I wonder what they talked about and I could probably find out if I wanted to take the time to dig it out.

Life histories and obituaries

The class secretary of 1912 hasn't waited for obituaries to get interesting information about his classmates. Perhaps you have read the interesting "life histories" that Guy Wilson has gone after—and gotten. In his letter to "Dear Classmates" he suggests eight areas as a basis for those histories. Please read the 1912 notes and then prepare and promptly send me *your* life history.

A letter was received from Mary R. Holmquist whose husband *Charles Albert Holmquist* passed away September 27, 1968, probably in York, Maine. They had been living there since Charles retired in the early fifties, after an outstanding career, all with the Division of Sanitation of the N.Y. State Department of Health in the Capitol in Albany. Charles had the title of Sanitary Engineer for some 15 years or so, and was Director for another 25 years or more. Lacking an obituary I have no information about their family but a letter has been sent to Mrs. Holmquist extending deep sympathy from the Class to her and their children.

It has been my practise when I spot an M.I.T. obituary in the *Herald* to send it to the class secretary. That procedure often results in an interesting letter in reply, such as a recent one from Dix Proctor, '17. He referred to my mention of the Wellesley-M.I.T. "merger" in those early days and added, "I ran across a partially used commutation ticket to Wellesley as I took Astrology or was it Astronomy!" Ah sweet memories But it is surely different today, as attested by a clipping announcing for February 7 a joint dinner meeting in Hartford of the Wellesley and M.I.T. Clubs there when two students from each college "describe the cross registration program between M.I.T. and Wellesley."

The Christmas cards have arrived and many thanks.—Marion and Ned Rowe, Secretary-Treasurer, 11 Cushing Road, Wellesley Hills, Mass. 02181

07

Congratulations to *Dick* and Mrs. *Ashenden*, as they recently celebrated their 60th wedding anniversary at a family dinner party given at the home of their son Richard, Jr., in Winchester.

They have a married daughter, Marjorie Adair, Living in Paonia, Colo., who was unable to come East for the celebration. The Ashendens have five grandchildren and four great-grandchildren. Dick and his wife have lived in Newton nearly all their lives; they attended, and were graduated from, the Newton High School. Dick drew the plans for the house in which they have spent the past fifty years. Until his retirement twenty-two years ago, he owned the Boston Nickel Plating Company and also the L. L. Rowe Company. He sold the former company, and his son now operates the Rowe Company which built a new factory in Allston recently. They attend the Central Congregational Church in Newtonville, where Mrs. Ashenden has been very active in the choir.

New addresses

Paul L. Cumings has a new address; 770 Boylston Street., Boston, Mass., 02199. *Bill Otis* has gone to Florida for the winter. Write him at 1624-72 Gulf Shore Blvd., Naples, Fla. 33940—*Philip B. Walker*, Secretary-Treasurer, 18 Summit Street, Whitinsville, Mass. 01588; *Gardner S. Gould*, Assistant Secretary, 409 Highland Street, Newtonville, Mass. 02160

11

Leroy G. Fitzherbert sent me the following account of his life's work: "After leaving Tech, I spent several years with survey crews on hydrographic, railroad and highway projects. In 1919, having married the sister of our classmate, Donald N. Frazier, and having decided that I wanted a more lasting job than survey work (as it was necessary to look for new work when the survey was completed) I started as a fire protection and prevention engineer in Boston with the fire underwriters. In 1923 I joined the Home Insurance Company of New York as engineer for New England. After several

years, the company transferred me into the production field and I was made special agent, then manager of the Boston Office and finally Local Secretary. During my years with the Home Insurance Company I supervised the company's operations in the New England states. After 30 years with the company, I was retired in 1959 and have really enjoyed 15 years of contented and lazy life. My wife and I have done quite a bit of traveling, having made a round trip of the world, several trips to Europe and seven winter sojourns to the island of Majorica."

Fitz was born Sept. 12, 1888 in Cambridge, prepared for Tech at Somerville English High School and graduated in Civil Engineering. He was quite active in student activities at M.I.T., being in the MITAA, the Tech Show, on *The Tech* news staff and other activities. The Fitzherberts have 13 grandchildren and expect a great grandchild in June.

I came across a long article in the December, 1968 issue of the *American Legion Magazine*, "I fought the Red Baron," by our classmate *M. Curtis Kinney*.

One change of address: *Lloyd A. Patrick*, Rose Villa, 13505 South East River Road, Portland, Ore. 97222. The following came from *George A. Brown* along with his contribution to the Alumni Fund: "Rather limited at present in physical activities as I was in the hospital a year ago due to a heart condition and have to take it easy. Two years ago my wife fell and broke her hip and after her return from the hospital passed away suddenly due to embolism. My activities consist mainly of reading, correspondence and some painting with oils and water colors for my own amusement. Will be glad to hear from any of my old classmates." I'm sorry the notes are so short this month but you fellows have not done your duty. WRITE TO OBIE!—*Oberlin S. Clark*, Secretary, 50 Leonard Road, North Weymouth, Mass. 02191

12

DO YOU REMEMBER the All Technology Reunion held in Cambridge and at Nantasket Beach in 1916 to celebrate the

dedication of the new buildings in Cambridge? At that time the Harvard Engineering School had been merged with Tech, and we felt we had taken them over. The photos taken at Nantasket show the whale we made (a frame of steel rods covered with cloth) and marked M.I.T. Beside the whale is *Bob Wiseman* as Jonah soon to be swallowed by the whale, with an H for Harvard on his costume. *Hugo Hanson* is in the rear, working on some of the equipment. The second photo shows Bob, Hugo and *Ken Robinson* getting the act ready.

Hundred year history

We are pleased to hear again from *Willis Salisbury*, who last year sent in the interesting story of his trip to the Iron Curtain countries. This "history" goes back over one hundred years. "My birthplace was determined by my grandfather, who moved from mid-New York state to Iowa just in time to volunteer for the Union Army. Father was born there in 1861. Grandfather moved the family to Minneapolis in 1877 where he started a mattress factory. My father was married in that city in 1885, and in due time four sons were added to the family, of which I was number two. There was never any question in any of our minds but that we would enter the family business as soon as we were out of college. After graduation from University of Minnesota in 1910, I was persuaded by a graduate friend of M.I.T. to go there for further education. I registered in the Class of 1912 and was warmly welcomed by my fraternity brothers of Theta Delta Chi, among whom were *Weenie Schell*, *Ward Gere* and *Harvey Benson*.

"On my way east that fall on the train, I met a charming girl from Duluth, who was completing her senior year at Lasalle Seminary in Auburndale. I was most interested, but did not see her again for some time, as she was called home by illness in the family. Fortunately, we met by chance in Boston the following January and at once the old flame again flared up. I quickly shifted my interests from Smith, Barnard and Wellesley to Lasalle.

"On my way home that spring by ship from Buffalo to Duluth, I was surprised and pleased to find Eleanor on the ship (well chaperoned). Next fall she entered a hospital in Minneapolis for a nurses' training course, and the following spring (1912) we were married. Two fine sons and a sweet daughter arrived during the next seven years. In the meantime, my elder brother and I were learning the business, he in general management, and I in manufacturing. Some years later, a younger brother took over the sales burden. My other brother enlisted in the Navy in 1914 and made it his career, earning the rank of Captain in Naval Air Corps. My father died in 1918. Our business expanded to include the manufacture of all types of mattresses, pillows, bed springs, various types of metal beds and bed davenport, also hospital beds and furniture. My two younger brothers died, and the elder and

I both retired at 70, leaving the business in the capable hands of my two sons. Eleanor and I lost no time in starting a new career—traveling. We took several trips to Europe, each of several months duration, driving on our own; also cruised the Caribbean and Mediterranean and to the North Cape. We visited the Orient and spent four months travelling around the world. We also wintered in Mexico and Hawaii. Best of all are the memories of our happy summers at our cabin near the Canadian border on Hungry Jack Lake, until the passing of my dear Eleanor late in 1966. The following year I attended our 55th Class Reunion, visiting Expo 67 on my way home. In September, I took a most interesting tour with the Minneapolis City Planning Commission to the International Convention in West Berlin, also visiting Scandinavia, Russia and several other countries, as described in the February 1968 issue of the *Technology Review*."

Didn't heed advice

Henry Foley surprised us with a most complete story of his diversified activities during the past 57 years. We quote: "To go back to the beginning, I did not heed the advice of Professor Jackson to graduates of Course VI, that we get out of New England as soon as possible. In fact, I located in my home town of Palmer, Mass. as a power sales engineer for a new syndicate which had just acquired some twenty electric light companies, scattered about the state. After seven years, I moved to Springfield, Mass., doing work as an electrical contractor. At last, in 1926, I moved to Detroit and accepted an interesting position in the Engineering Department of the Fisher Body Division of General Motors, who were radically expanding their plant. I was soon in complete charge of the layout and installation of a plant electrical system amounting to over \$1,300,000.

"Unfortunately, the crash of 1929 practically wiped out our department, and I was fortunate to get a job with a Detroit firm with whom I continued as Sales and Service Manager until the outbreak of World War II selling fuel oil. In 1941, I returned to the Fisher Body Division in Pontiac, where I was put in charge of proof-firing their new 90 mm. anti-aircraft guns at the nearest Army Proving Grounds in Ohio. At the end of the War, the Pontiac plant moved me into a field of work with which I was entirely unfamiliar, Industrial Relations. Here I continued until my retirement as Supervisor of Salaried Personnel in 1954, at which time the plant had slightly over 10,000 employees.

"However, within a month after 'retirement', I accepted an offer of consultant to the city manager of the City of Flint Mich.—200,000 population. A \$16,000,000 program was being instituted, including a city hall, police station, public health building, municipal court, fire station, and a sewage treatment plant. And I was to be in charge! Of course, I had had construction experience, but it was entirely

factory construction, quite different in design from public buildings or a sewer treatment plant. However, I managed without too great difficulty and found it all most interesting; also much more remunerative than retirement.

"In 1964, I retired permanently and have since been enjoying life. My wife and I celebrated our fiftieth anniversary in 1965. We have four sons: (1) a Columbia professor of nuclear physics; (2) a State Department official in Washington, after 20 years of foreign service; (3) a sales department manager for Ford Motor in Detroit after 10 years abroad; (4) a Detroit lawyer, presently a candidate for Judge on Michigan Court of Appeals. All four sons are happily married and we have 15 grandchildren. As you can see, we have had a most diversified experience, but an interesting one. Life has been good to us in many ways. We have enjoyed several trips to Europe in the past 15 years, in fact I missed out on our Fiftieth Class Reunion because we were in Leningrad at that time. I surely have enjoyed reading the *Tech Review*, especially the expanded news of 1912. I wish you good luck and success in this effort, and if you or any other 1912 men come out this way, I hope you will try to visit us. Don't forget, 'It's later than you think!'"

Classmate deceased

Regretfully, we have learned of the passing of *Harvey Benson*, who died in Melrose, Mass., on November 6 after a short illness. In fact, *Jim Cook* had talked with him by phone only a few weeks earlier. Harvey was most active during four years at Tech, both on the Varsity Track and Cross Country teams, becoming manager and captain of each, and also served on the Athletic Association and the Executive Committee. During World War I, he was a Captain of U.S. Army Ordnance, following which he spent five years with A. T. Thompson & Co., becoming president. He then joined the United Shoe Machinery Corporation with which he was connected for 27 years, retiring as administrative engineer of their vast research program. He was company representative to the Industrial Research Institute and served as Institute president for two years. He is survived by his wife, Vera, a son Peter, a married daughter, Mrs. Elizabeth Grover, six grandchildren and two great-grandchildren.

Cussing is his favorite sport

I am paraphrasing from a letter received from *Cornelius Duyser* who has lived for many years in New Hartford, Conn. "I am in the same predicament as the barber when the bald-headed man came in for a haircut, I scarcely know where to begin. During World War I, I was in the Nitrate Plant at Muscle Shoals, Alabama in charge of office engineering, progress reports and estimates. Since then my activities have been in the general construction field and included bridge and dam building, filter plant operation, construction and maintenance, and bridge design. I specialized for many years in

estimating, appraisal of fire damage and various construction problems. In 1960, at age 73, I decided to call it a day and retired. For a brief period I was vice president of the Standard Engineering Corporation of Chicago, now defunct. "I was married in 1919 to Gerda Kleist, a Boston girl and the best prize I gathered in that city. She passed away in 1965. We had two children. The daughter married a professor in the college at New Britain, where she also does some teaching. They have one daughter. My son is an instructor in Newington, Conn. He also married a Boston girl and they have two young children. At this date it is too late for hobbies or sports. I was interested in the New Hartford Philharmonic until its demise. In my opinion there is nothing worth while on radio or TV. Perhaps my best sport is cussing out the administrations and the courts, who seem to know more about turning criminals loose than they do about law. For a conclusion, may I venture the statement that according to the papers there is more money to be made in bank robberies than in engineering these days, and a course at M.I.T. placing this subject on a higher, scientific plane should prove attractive. My best regards to all our 1912 classmates!"

Wants to contribute

A brief note from *Dave Guy* reads, "You know the first thing I do upon receiving the *Review* is to turn to the 1912 stories. I am looking for more and enjoy them all. But there is one thing that evades me and that is my own. But don't close out the series with a hundred of us laggards still out. I think the whole idea is fresh and wonderful and do want to contribute. I have mine ready,—the delay is all in the transfer from mind to paper. I'll start right away allowing for interruptions. My goodness, tomorrow is my 83rd birthday!"

Once again, at the last moment, we received sufficient news material to make a creditable showing. We are presently recovering from bruises and cracked ribs sustained in an auto accident and are most fortunate that we are able to be about. Jay writes that he is planning to leave soon for Acapulco where he and Priscilla have wintered for many years.—*Ray E. Wilson*, Secretary, 304 Park Avenue, Swarthmore, Pa. 19081; *Jay H. Pratt*, Assistant Secretary, 937 Fair Oaks Avenue, Oak Park, Ill. 60302

13

We regret to note the passing of two classmates. *Ernest S. Neilly*, of Aylesford, Kings County, Nova Scotia, Canada, died October 31, 1967; *George A. Richter*, of 28 Monroe Ave., Pittsford, N.Y., died December 3, 1968.—*G. Philip Capen*

(Your Secretary, although ill with the flu, called the *Review* to request that the above information appear in the class column. Get well soon.—Ed.)

14

Reunion planning is stirring some reminiscences by classmates who have not been heard from lately. For example *Ralph D. Salisbury* writes to *Les Hamilton*: "Dear Hamilton: Writing the enclosed letter to you brought back the days

I wish that I were back again,
At the Tech on Boylston Street,
Dressed in my Dinky Uniform
So dapper and so neat.

(The uniform that every bellhop in Boston wore after buying second hand from students.) We all had to drill as freshmen; but you were a lieutenant that same year; and when I was first lieutenant as a soph you were Captain and Company Commander. Of course the record shows you went on to be Battalion Major and the Cadet Colonel. But I wasn't around to take part in those drills. The last time I had command of the company I tried some of the tricks learned at summer camp with the 15th Illinois Regiment. (United Boys' Brigade of America before there was any Boy Scout organization, or any song titled 'I Didn't Raise My Boy to Be a Soldier'!) In the resultant confusion I had to dismiss the company and then reform them—somewhat like Abe Lincoln getting his militia company across a fence in the Black Hawk war. Any way I didn't go back; hope you got along without me for the second semester.

"Hoping to hear from you as to the plans for the reunion; and to see you in person if I get there. Sincerely yours, *Ralph D. Salisbury*."

Look him up in Corpus Christi

Some correspondence with Busby and passed along by *Dinny Chatfield* tells of his geographical plans. The first letter isn't from Corpus Christi. "I appreciated your card from Grand Canyon—guess you must have really been in an exploring mood to get out that far. We too are on the move—not, however, to explore but to get closer to the children, away from winter and have the seacoast. June 30 we are moving to Corpus Christi, Texas. The move has been under consideration for a long time—crystallized finally after two trips to Texas this year. Our address there is: P.O. Box 1314, Corpus Christi, Texas 78403.

"The region here has far too much rainfall to be comfortable. It's all above 56 inches a year and much of it is up to 100 inches. As a result mildew is an ever present problem. I would estimate that one third of our fuel bill is devoted to combating it and it makes a fine breeding ground for throat ailments! Surprisingly though on the coast of the Texas Gulf region it averages only 16 inches of rainfall every year.

"There have been many disadvantages to living here—chief among them was local dental and medical skill and

almost no shopping facilities. One has to go to Asheville (30 miles) to buy small tools or stationery supplies. I should appreciate it if you would pass this new address along to Harold Richmond or any of the others in the Class of 1914. And if you ever get to C.C. look us up and we'll hoist one for old times."

The second letter a few months later, also from Corpus Christi makes it look like the East has really lost another good man to the West, or perhaps one should say the Southwest. "Dear Dinny: We arrived here October 7th and got an apartment two days later—fortunately a well located and arranged one. We 'camped' there until our furniture arrived a few days later. While it has been possible to get most urgent things arranged in this period I still realize that the one who said 'We do the impossible things a little later,' had a point. (I'm still trying to find a printer who can do as good a job as the one in Brevard did with this letterhead. He was a rarity in any community, a real craftsman. Even Asheville had none as competent.) Thanks for the two addresses. I'll look up Alden if I go to Austin later (which I may for a visit). We probably will not go to Houston until next June when Edith's niece is getting married.

"While you have been having the usual atrocious New England winter the days have been delightful here—mostly summer and in the 55° to 75° range. We have very little rain, no haze or fog. That North Carolina region was deceptive—its 100 inches of rain a year ruined a large proportion of the forenoon and many whole days. I don't intend to do much future traveling outside of Texas. There's a lot to see in Texas and the children are in Dallas. . . . And I have some business interests in Ft. Worth. This is quite an active seaport, 7th or 9th in the U.S., and the variety of excellent fresh fish suits my North Shore origin. The best shrimp and the sea trout here is a marvel.

"I'm probing some interesting possibilities locally—I have to have something to do—tho not violently. . . . It's actually good to be back with city facilities. We have an excellent newspaper and first-class educational facilities, good libraries and cultural activities. You know, of all the cities I ever lived in I liked Hartford the best—but my old bones can't take those New England winters any more. Come and see us. It's the best, unspoiled seacoast left in the U.S."—*Herman A. Affel*, Secretary, Rome, Maine. Mail: RFD 2, Oakland, Maine 04963

Our first Christmas card was from *Mary Plummer Rice* in Paris: "The time is drawing near to leave my carefree life in London, working for the Red Cross in three hospitals, seeing shows, shopping and having clothes made, loving every one and every moment. London is a fascinating place, even the dreary parts have such romantic names. Two of us—she's from Winnipeg—go off on day bus trips to the country-side and the beaches. I'm moving into my Bronxville apartment December 21, after a long trip home via Portugal, Martinique, St. Thomas, Barbados and Nassau on the 'France.' Have a wonderful Christmas." It's delightful to hear from Mary she's a marvel to keep going so actively.

The next early card came from Ruthie (Place) Hickey: "Don't laugh at this early card, but we are leaving for another trip on December 14. It was grand seeing you both and being with you in Boston."

Ken Boynton's card is a colored print of Helen and Ken squinting in the sun on a sandy Florida beach. Ken wrote that on their drive to Florida and the Gulf they stopped at Daytona Beach to go "shell-ing." In the picture, Helen is holding the rare "sand dollar" shell.

Lena & Jim Tobey's early Christmas card regaled us with their suffering at West Palm Beach—80° all day and 40° at night. They drove 1,542 miles via the West Coast (of Florida) to get there. What a life!

Tidbits

A colorful card from Connemara County, Galway, Ireland from Lucey and *Harry Murphy* praised "the pubs" of that lovely country. Admiral Perry, who made that famous expedition to China in the 1840's came down from some of *Al Sampson's* Mayflower forebears. Al is now concerned that our deceased classmate, *Pellian T. Mar's* grandson, Sampson Sam Mar, may be named for one of Al's ancestors who did a little shore-side researching in China. *Larry Landers* has set up our annual New York City class dinner at The Chemists' Club there, on April 18. Plan to be there to greet the Boston delegation going over for the party. While in Boston at the meeting of the Northwest Electronics & Research & Engineering Society, *Phil Alger* visited The M.I.T. Press in regard to their publishing some of the books he is currently writing. Phil really keeps busy.

Two years have gone by quickly so it's again time for our modest biennial class dues. Sometime this month you'll receive the notice. Send your check. There'll be no high pressure solicitation nor follow-up on this. I know you'll all do your part. Many thanks.

In answer to the Alumni Association's request for notes for our column, *Bill*

Smith answers, "He knows too much about me already." Now, Bill is a nice guy so I wonder what he means?

Harold Edgerton is retired and living in Nokomis, Fla. He's a golfer at The Lake Venice Golf Club, Venice, Fla. In April 1965 he was remarried to Muriel Potter Otis. Nice to hear from him.

From the October 1 Jacksonville *Journal*, the story of the Board of Library Trustees says: "*George W. Simons Jr.*, a graduate of the Massachusetts Institute of Technology has worked as a municipal planning consultant throughout the South. He is a past president of the Florida Engineering Society and a past commissioner of the Jacksonville Housing authority.

Early in December, *Jack Dalton* was elected to the Advisory Committee of the famous New England Baptist Hospital in Boston. Another of Jack's many civic and community activities. *Evers Burtner* writes: "We surely had a fine fall get together at the Tech Faculty Club, thanks to you and the Pirate. This fall I retire as measurer for the Eastern Yacht Club of Marblehead after 53 elapsed years of service rewarded by an Honorary Life Membership, a fine clock, and another gracious gift. The principal speaker at the annual banquet on November 15, of The Society of Naval Architects and Marine Engineers, attended by some 1700 members, was our M.I.T. President Howard Johnson. (He received hearty applause for his address). At the same dinner Professor Frank Lewis, Emeritus, Department of Naval Architecture and Marine Engineering, and I, a Society Honorary Member, received Fifty Year Membership Certificates. I am still working on my rather unusual hobbies." Congratulations to Evers on his award. I wonder what his unusual hobbies are.

Bill Mellema: "After 23 days in the hospital for serious surgery, I am all right now. I am pleased and proud about the terrific research work being carried on at M.I.T. Let's not fall behind Cal Tech or any other school."

He sleeps on the tool chest

Here's a letter from *Ernie Loveland* at the New Hotel Zamboanga, Zamboanga City, Phillippine Islands. "I am still in the Philippines working on a research job on a special seaweed for the University of Hawaii. I have three men working with me down through the Sulu Sea making monthly inventories of this particular seaweed on the various beds where it grows and I have two more assigned to me by the Philippines Fisheries Department working harder under me than they ever have before here in Zamboanga where we are trying to determine the effects of different conditions on its growth. Of course I am working longer hours than any of my men. Since the first of the present year I have worked seven days a week from early in the morning until late at night. On Christmas Day 1968 I worked

in my hotel room until noon time, then I went out to a Peace Corps headquarters nearby for my Christmas dinner. I got back at 3:30 and then worked until 10:30. To show the difference between a Filipino and myself: A few weeks ago one of my men came in on Tuesday morning saying that his foot ached so he went right home again. I didn't see him until Friday. Meantime on that Thursday I was taken to the hospital in a wheel chair and put flat on my back about half conscious and very sick. Despite this the next afternoon, against the doctor's orders I talked myself out of the hospital and was back working in the lab at 5:30 but then I didn't have anything as serious as a foot ache.

"We are now working hard getting into cultivation of this seaweed so I shall be there probably at least for another year. I spoke of three men working for us through the Sulu Sea. They are on two different boats that are collecting the weed and bringing it back to Zamboanga in one case and to another port in the other case for sorting, baling and shipping. When I first sent them out Honolulu thought that I should go with them on the first trip to supervise before leaving them on their own. But the boat operators absolutely refused to take me. Feared that the presence of a 'rich American' would attract pirates. And although I didn't go, on the very first trip by my men, they were fired on by pirates who were driven off by our boat returning fire.

"Although I have been at Zamboanga most of the time, have had to spend some time at various other seaside places. One incident on one of these trips I remember. Honolulu wanted me to investigate Siquijor Island offshore from Bumaguete. So on arriving at Bumaguete I took one of the small outriggers, but motor driven boats crossing over to Siquijor carrying passengers. Very rough weather and to keep the boat from from turning over two men were stationed on one set of outriggers and one man on the outrigger on the other side of the boat. As an outrigger started to come out of the water the man or men stationed on that outrigger would, holding onto the outrigger cables, walk out on that outrigger to bring it back onto the water. Halfway across I looked up above me and saw a wave about 8 ft. high bearing down on us. When it hit it broke the mast at its base, thus loosening the outriggers. A native woman cried out and prayed all the rest of the way over. Truthfully, I myself, didn't think we were going to make the other shore but felt no fear. Guess I thought that if we capsized I could hang onto some part of the boat although in those high waves it didn't look very easy. However, we got across. "I hoped that I could, before long, cut out working on the Sea Weed Experiment Stations up to 10 to 11 p.m. every night 7 days a week. I recently joined a 3rd year Spanish class at the Zamboanga A.E. College 7 p.m. to 8 p.m. three nights a week.

"By the way, some of my trips to small seaports have been by boat overnight. Do you get a cabin? No. Everyone sleeps on the deck on folding cots which are placed right against each other. As a result, first, the man on your right side flings out his arm in his sleep and hits you. You get to sleep again, and then the man on the left does the same thing. As a result I long ago learned to tell the boat boy 'Put my sheet on top of the tool chest. That is where I shall sleep.' Hard? Yes, but away from the arm flinging crowd." After you have read this you will no doubt join with me in wondering when Ernie sleeps and why he is doing all this.—Aze/W. Mack, Secretary, 100 Memorial Drive, Cambridge, Mass. 02142

16

From our ever-doing president *Ralph Fletcher* we have this welcome opening message: "On or about the 24th of November, I was deluged with birthday cards, letters, telegrams and various epistles conveying congratulations and good wishes on the occasion of my 73rd birthday. The number of these from classmates finally totalled 118. When the storm commenced I began to think I was quite a guy but as it progressed during a week's time I realized it was simply a matter of reflected glory because of my office and association with the Class of 1916. And then it all began to make sense. . . . I acknowledged to myself again as I have so often in the past that 1916 not only was the last class to graduate from the Tech on Boylston Street but was the best class that ever graduated from Boston Tech! Then I began to wonder more than I had ever done before—why, why is 1916 so outstanding?

"The traditions of the Tech on Boylston Street had fully matured by 1916, and we as a class had the benefit of these traditions. We were forged and tempered in a discipline which had developed during the previous 50 years.

In our case the Institute had exceptionally fine material to work. Having suffered with and benefited by this discipline we acquired a common bond, a bond which has held us together over the years and seems to draw us closer to each other as the years pass by. I acknowledge with humility and pleasure the many good wishes I received on my birthday. This affection of Sixteeners for one of their number is further evidence of the strength of their common bond. Surely 1916 is the best class that ever graduated from the Tech on Boylston Street. There is nothing better than the best, even though others may be 'supreme.'

"While it is only February and we have not yet mailed out a formal notice of the upcoming 53rd Reunion, we are already getting indications of growing enthusiasm for our week-end in June at Chatham Bars Inn. On that same week-

end, M.I.T.'s 50th Anniversary Class of 1919 will also be celebrating its reunion at Chatham Bars Inn. Remember the dates—June 13, 14 and 15. Plan now so that you will be able to attend. Sibyl and I looking forward to the week-end on Cape Cod when once again we will be able to enjoy personal contact with you who have added so much happiness to our lives. See you in June "

A guest of high distinction

Our monthly joint 1916-1917 class luncheons at the Chemists' Club in New York (52 E. 41 St.) occasionally sparkle with guests of high distinction. The December 5 luncheon was outstandingly one of them when our ex-President Julius Stratton flew down from Boston and joined the group. The conversation during and following the luncheon made it a time to remember. The flu epidemic cut into attendance but those present included *Joe Barker*, *Rudi Gruber*, *Herb Mendelson* and *Peb Stone* of 1916, and *Ed Aldrin*, *Dix Proctor*, *Dick Loengard* and *Clarence Seely* of 1917.

Worth reading again

Van Bush gets another old-fashioned A plus as his "The Search for Understanding," one of ten essays in his recent book *Science Is Not Enough* (Wm. Morrow & Co., New York, 1965) continues to be highlighted in science circles. It has been reprinted again, this time in the August 1968 issue of *American Scientist*, the official publication of the Society of Sigma Xi. As we know, it appeared in the October/November 1967 issue of the *Review* and in our March 1968 column we quoted some of the fine comments of the book review in the *New York Times*. This surely is something that is worth reading again and again.

Transplantation

During the past three years *Blythe Stason* has been working on a novel undertaking involving law and one of the medical frontiers—transplantation of human parts. As Chairman of the Special Committee on the Uniform Anatomical Gift Act of the National Conference of Commissioners on Uniform State Laws, he has had the task of doing the research and drafting the Act. The National Conference is an affiliate of the American Bar Association, and over 77 years of existence it has drafted a large number of acts that are now on the state statute books. The Uniform Anatomical Gift Act, after three years of study, was finally approved by the Conference on July 30, 1968 and by the American Bar Association on August 7.

The act seeks to provide a nation-wide legal environment for transplantation, eliminating the many problems left unsolved in the present hodge-podge of diverse state legislation. The Act has already been adopted in four states and within the next few years will doubtless be widely accepted. To Blythe, working on the Act has been rewarding—not fiscally but in other ways.

Joseph Warren Barker Fellowship

You will be interested in the essential contents of an October release from the M.I.T. Office of Public Relations: "Terry Lee Holcomb of Colorado Springs, Colo., a graduate student at M.I.T., has been awarded the Joseph Warren Barker Fellowship for graduate study in the Department of Electrical Engineering. The Joseph Warren Barker Fellowship in Engineering is sponsored by Research Corporation (a foundation for the advancement of science), New York City, in recognition of Dr. Barker's leadership of the foundation over many critical and vital years. Mr. Holcomb is enrolled in the cooperative VI-A program which requires four terms of industrial practice as a way of gaining industrial and research experience concurrently with his undergraduate studies. Mr. Holcomb has been working at Radio Corporation of America's David Sarnoff Research Center, Princeton, N. J. While there he worked on an optical systems evaluation and digital electronics systems design. He will receive a Bachelor of Science and Master of Science degree simultaneously in June 1969."

When the moon got out of the way

It's too late now, but if you had been interested in studying the stars and planets and the moon in November, all you would have had to do was to drive out to Arizona to a place called Apache Junction n miles east of Phoenix (n is maybe about 30) until you came to a mobile house sitting comfortably in the desert sands, with a home-made telescope (160 pounds weight more or less) plunked down firmly in the back yard. There you would find *Harold* and *Louise Mills* of Mountain Lakes, N. J., and *Harold* bubbling over with delight at the clear-sky conditions for watching far away places. Back in mid-October, on an unusually sharp night here at home, he showed us our 70,000-mile-diameter sister planet, Saturn, and her rings of double that diameter. Reports from Apache Junction are enthusiastic with a list of things such as: "a fine view of nearby Superstition Mountains, a nice breeze most of the day, a nice patio outside, a nice landlord, no noisy neighbors, apparently good telescope 'seeing' when the darned moon gets out of the way, jumping cholla cactus, octillo and palo verda bushes, many giant saguaro cactus 20 feet high and the flat desert nearly all around."

A bit of philosophy

When we asked *Don Webster* for a "bit of philosophy" he replied he would "tell it like it is." "My philosophy is simple, and as before—*carpe diem*. We are only ants on a small pill in a limitless universe, each living in an instant of time. Our pill, in its orbit around the sun, is in a fine balance between its centrifugal urge to fly off and get us all frozen quickly and the gravitational urge of the sun to pull us in and incinerate us. So I will not worry at my age about what Thomas Gray calls 'the madding crowd's ignoble strife'—the pushing and pulling of us ants against one another.

What we need is fewer ants on the pill. The weather in Falmouth has been divine since the first of June, a procession of halcyon days, perfect for beach living. Really too close to Heaven for us sinners who don't deserve such good treatment. We Cape Codders need a little dirty weather now and then to keep our characters sturdy."

Down South

Now in a series of steps down into the South, we start with Dr. *Val Ellicott* of Baltimore, who can always be counted on to reply. This time he writes: "No news. No Philosophy. Nothing but a message of thankfulness; fond memories of the fine courses we had in the old buildings in Back Bay, and admiration of our fine secretaries who keep us backsliders informed." Then *Edward Hall* of Baltimore (and of Marathon, Fla. in the winter) reports taking the S. S. Rotterdam to Cobh in June and having 12 days with no rain touring Ireland; then to Bergen by plane and to the North Cape on the M.S. *Stella Polaris*; then to Oslo, Copenhagen and Amsterdam to take the S. S. Statendam home. And from Charlottesville, Va., *Wes Blank* says he and his wife chose to see our country instead of taking a foreign tour, including the National Parks, Vancouver, Lake Louise, Glacier Park, all in British Columbia. Says: "We found the scenery compared fully and favorably with that in Switzerland and Austria." And in the fall, *Wes* helped at the local Nixon political headquarters "and we brought Virginia into the Republican ranks."

We are glad to report that *Everett Johnson* of Monroe, La., is doing better following a period on the sick list with two trips to the hospital during the summer. And we were glad to have word from *Stew Rowlett* in mid-November saying he was feeling pretty well then, after having a hospital visit back in September. He expects to live to a good 86 years, same as his brother, and looks forward to attending the 53rd Reunion next June at Chatham Bars Inn, Cape Cod (June 13-15).

And another report from way down South, this one from *Art Shuey* in Shreveport, La. The best way to tell about it is to give it to you in Art's inimitable words:

"I just arrived from three weeks in Scotland and England, spending two weeks in Campbeltown, Argyll, with relatives and old friends. I hoped to get some salmon fishing but due to the dry season the salmon had not started to run. However I did some pleasant trout fishing in small lochs. Had a pleasant summer too. I took two grandsons, 15 and 16, through our western national parks, Canada and down to San Francisco. They are boy scouts and wanted to camp about half of the time which we did. They did all the hard work and I was camp cook. The fact that I lost eight pounds and three inches around the waist may not recommend my brand of gourmet cuisine. We covered 7,050 miles and due

to the laxity of Louisiana law they both had driving licenses and did most of the driving. The old man did the mountain passes. *Vertrees* and *Sylvia Young* went to Baltimore—to Hopkins for another look at her eyes—and then on to Hartford for a Trinity Trustees meeting. Hope they won't lock Vert in this time. While I was in England, my surgeon (F.R.C.S.) had me out to tea with his family. He cut off two-thirds of my stomach some seven years ago and likes to show me off as a tribute to his skill. By the way, he prescribed at least a glass of dry wine with each meal and I have been very good about following his orders."

It would be horrible

Are you looking for a problem? We have one for you—not too hard. *Allen Pettee* moved early in December and sent us a new address, his P.O. Box number and his Zip Code number (in Tryon, N.C.) in the vigesimal number system of the Mayans. How do you write the Zip number 28782 in Mayan, for that is what he sent us. Actually all you have to do is to go back to page 113 of the July-August 1968 issue of the *Review*, bottom of the first column, for we have outlined the system of numbering in sufficient detail to enable you to do the figuring—let us know if you are successful. We have so far had no requests or problems in Mayan numerology as a result of Allen's contribution in the July-August *Review* and he writes: "Guess we are just lucky that no one wants to know anything more about Mayan numerology. It would be horrible if we had to work it through algebra and on into differential equations."

Allen says that when they moved to Tryon 12 years ago they "speculated on staying about ten years or until arthritic onset called for a climate significantly warmer than Tryon's thermal belt. However the years fly by with arthritis little or no problem, so we are taking the short immediate step of swapping our acre of mowing for a pint-size snuggerly in the center of town, just a long block from Tryon's new and fantastic fine arts center and the rest of the urban amenities."

Dovetailing

George Maverick of Charlottesville, Va., in an exchange of fine art information about wood carving with our own *Peb Stone*, says he finds wood a pleasant thing to work with. He started his first carving in 1959, after his 65th birthday and has particularly enjoyed making things for children and grand children. Says he to *Peb*: "You mention router dovetailing on the beautiful bit box" (one of *Peb*'s choice items). "With a router you can do 90 percent of the work on such beautiful carving, as I learned from *Lym Ford* in Texas. Using his ideas I made a mantle for my daughter that was very little work and has been much admired." He concludes that anything for a child or grandchild is really appreciated. Either *George* or *Peb* will be glad to give advice on proce-

dures if you want to carve easily "a la router."

In *Brad Curtis* we have another craftsman in wood—a maker of "things" out of wood. Says: "Have made three old-fashioned towel racks that stand on the floor, and they have been given away. Now I have orders for three more, for relatives see them and demand keeps up. I have some very good cedar wood that I brought from Massachusetts some years ago, and this makes very fine foot-stools and towel racks." And that reminds us—we have put a "three legged stool" on our Christmas list, for that is just what we need for picking dandelions in our front yard. In October *Brad* and his wife visited their daughter in High Point, N.C., the center of furniture-manufacturing in the South. *Brad* mentions their beautiful drive through the Blue Ridge Mountains, on the Sky-Line Drive. And "Also saw a moon-shiner's still all set up and ready to go (except the mash)."

A peculiar experience

Harry Whittemore writes from Guadalajara in Mexico. He speaks of another Tech man there—*S. Phillips Houghton*, '17—who he says is active in the American Legion and in the American Society. *Harry* himself is Past Commander of the Legion and Executive Committeeman for the Department of Mexico, and also a director in the American Society. Says he took in the "Fiesta" in Mexico City in 1966 but missed the ones in 1967 and 1968. Also says he has passed on the *Review* to friends, one of whom teaches math at both the high school and college levels and promotes space technology. *Harry* has been retired since 1963 and spends all his time in Mexico. Likes the weather very much and, most important, the cost of living, for he manages to live within his means and Government pension—something that is "important to relaxation and peace of mind." Then: "I had a peculiar experience back in the year 1918. *Rusty White* came out to the University of Washington to start the program for Navy aircraft. I was underweight by about five pounds and *Rusty*, a Lieutenant, tried to go over a Captain of the Navy Doctorship, and what a 'mess.' The same doctor readily passed me in the Marine Corps. Please tell me the whereabouts of *Rusty*." We had to tell him that *Rusty* left this worldly sphere in 1949.

Out West

Jim Evans reports high enthusiasm from *Robert Kallejian* of Whittier, Calif., for the 50th red blazer just received. We regret to hear that *Robert* had a stroke in September and trust there will be good progress in the months ahead.

Also from the West Coast, this message came from *Ken Sully*: "Emerald and I send greetings from Leisure World Laguna Hills. We are living in a glorified country club." . . . Also from California comes word from *Lev Lawrason*: "Thanks for the 52nd reunion picture.

They all look hale and hardy. My, how the time flies! I have been living in the Seal Beach retirement village for more than four years. The apartments keep pretty well filled, so anyone wanting to move can sell this interest readily. I spend about half my time either in Mandeville Canyon (West L.A.) or in San Diego county with my daughter, located on the San Diego freeway."

From even further west came an interesting letter from Frank Smith, '11, of Honolulu, with whom we had quality control contacts some years ago, and who was a colleague of Jack Freeman's in the American Brass Company, in Waterbury, Conn. Remembering the probability aspects of QC, he forwarded an article on "The Fine Art of Betting Horses," which indicated a way to get a high percentage on your money in this field "in the long run." Knowing *George Petit's* specialty, as a trend analysis consultant and this year a probability advisor to the manager of the Detroit Tigers, we forwarded the article to George for his appraisal and possible advice.

Last winter brought the announcement from *George Hale*, of Golden, Colo., of his first great grandchild, Jennifer Marie Nowlan. Now comes a second highly significant event: the arrival of the second great granddaughter, Michele Marie, born September 16, 1968 to Elizabeth Nowlan and Joseph W. Davis. George adds that the new father had received orders to report for duty in Vietnam during October 1968.

From the letter box

Herb Gilkey of Ames, Iowa, retired professor and head of the Engineering Mechanics Department, Iowa State College, says all is well as usual and nothing newsworthy to report except, possibly, that "I've recently completed a 3-page attempt at a biography of the late Dean Anson Marston, Iowa State's grand old man of engineering—now in press." We are still intrigued with the way Herb answered the question: "What in your career gave you the greatest satisfaction?" for the 50th Reunion Class History; thus: "Enjoyed the tout ensemble which included: the classroom contacts; the departmental staff and organizational aspects; the research and technical authorship including author or co-author of several books and many bulletins, discussions, technical papers, etc.—over 150 in all. It has added up to make life seem reasonably worthwhile. (About what a sand box does for a kid)."

Bill Drummey tries to tell us in Latin that his 75th has come and gone, but we can't unravel his "classisist" material for we had manual training rather than Latin in high school. He says: "Somehow I think the calendar must lie for I don't find much change in the last 20 years—doubtless due to the general sanctity of my living!" Then he writes of something he is evidently very proud. Says that a rather large, private party, held on October 25, made a happy

"fuss" over him, featured by a courtesy proclamation by His Excellency Governor Volpe, duly great-sealed and signed, with the expression, "which is worthy of recognition by all Citizens of Massachusetts." Adds Bill, "and to me, a registered Democrat!"

Shatswell Ober continues to watch for possible '16 items back on campus. He reported in October that at the M.I.T. Professors Emeritii luncheon he saw Steve Simpson (Course V) who appeared hale and well. He also saw two fine oldsters, "Professor Joseph Riley, '98, (heat engineering) and Professor Phillips (math), a remarkable pair as some of you may remember. Philosophy—how to feel old: I just voted for Congress for the son of one of my early students!"

Duke Wellington reports "nothing new or exciting except" the addition of three more great grandchildren for a total of 14. Maybe 14 is some kind of a '16 record—we just don't know. We'll have to wait for more information. Duke does have a thought that may be useful: "If one wants a nice quiet summer vacation, don't own a cottage on the shore or anywhere, for you will get all your relatives and friends dropping in for a visit without letting you know."

After 30 years in the same house in Chatham, N.J., *Hank Smith* and his wife made the big decision. He writes: "We advertised the house and sold it in two days. We moved into Leisure Village in Lakewood, N.J., last April and are quite well satisfied with the new location and environment. You should come down and give Leisure Village a general inspection—it's quite a place."

A little about life in a retirement home is what *Ralph Spengler* writes us from Wade Park Manor in Cleveland: "Your letter is here asking what I have been doing. Living in the Manor where inhabitants are 80 per cent women there are many little things to do. Mending chairs, tables and assisting feeble ones to their rooms consumes a lot of time. The last two months have been spent helping my sister to get over an automobile accident that was quite serious." Ralph says his doings are not of much interest to anyone but himself. His daughter and five children are 800 miles away but he keeps in touch by telephone at least twice a week. There, he says, "I always find things happening."

And now again we close for the time being. Your prompt replies to our little requests are very much appreciated. Just keep writing a little but writing often to your warm-hearted secretaries—anything in the line of news, bursts of thought or philosophy.—*Harold F. Dodge*, Secretary, 96 Briarcliff Road, Mountain Lakes, N.J. 07046; *Leonard Stone*, Assistant Secretary, 34-16 85th Street, Jackson Heights, N.Y. 11372



Nelson Chase, '17, displaying a water color of the M.I.T. President's residence by Jim Flaherty, '17.

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As reported in an earlier issue *Jim Flaherty* presented President and Mrs. Johnson a painting, which he had made, of the entrance to the President's House. So that everyone can enjoy Jim's art we are showing above Nelson Chase holding the painting. . . . This past June *John M. De Bell* received the "Man of the Year" Award from the Enfield Chamber of Commerce. De Bell was cited for his efforts in establishing Social Services, Inc., The Mental Health Center, and voter redistricting. . . . It is reported that last October there was a one-man show in Brockton, Mass., of paintings by our A. P. (Brick) *Dunham*. As many will know, Brick is partially color blind, yet he has been painting for years as a hobby, mostly landscapes, but portraits too.

John A. Lunn has been elected chairman of the Massachusetts Small Business Investment Company. Al is a former vice president of Kendall Company and now a director of Kendall and several other companies in both manufacturing and finance. Raymond Stevens, the retiring chairman, will continue on the re-elected board. . . . Mrs. *Adele Morton*, widow of our *Bert*, writes that he had a very fine collection of technical magazines dating from 1939 to 1966 and she advises being very happy to have the University of Maine take his entire collection. . . . *Charles G. Miller*, 51 Aubrey Road, Upper Montclair, N.J. 07652: "I am still reasonably active but officially a retired Bell System engineer since 1957."

K. E. (Ken) Bell, Melvin Village, Mirror Lake, N.H. 03853, keeps on the go in A.I.D. work for the State Department. In August he was off to the Dominican Republic for a week, with the prospect of two weeks in Morocco. . . . *Frank L. Butterworth*, 2620 South Weston Avenue, Marion, Ind., 46592, is reported to have made a fine recovery from surgery of a year ago. He had hoped to get to the 51st Reunion, but conflicting dates

prevented. Wonder if we would recognize him now that he has taken off 47 pounds.

Harry A. Wansker advises that some construction work prevented his attending the 51st Reunion. Was this a Massachusetts or Florida project? In any event trust satisfactorily completed.

Classmates deceased

Quoting from a Framingham, Mass., clipping entitled, "*Ralph (Deac) Sawyer*, Business Leader—War Veteran, of 49 Warren Road died Nov. 8th, 1968 after several months illness. Born in Framingham he had long been engaged in business and industry. He graduated from Framingham High School and immediately following M.I.T. entered the U.S. Naval Service as an ensign and served in Washington, D.C. He was among the pioneer instructors in naval aviation and during part of World War I he served as an instructor in aeronautics at M.I.T. He joined the management of the H. L. Sawyer Hardware Co., which had been operated by his father and this business was continued for many years. He became general manager of the Lombard Governor Corp. in Ashland, a position he occupied for 18 years before his retirement. In civic affairs he was a leader in the Chamber of Commerce, and served two years as its president. He was also a former member of the Framingham School Committee. He served on the committee of unemployment in the Depression years of 1930's. He was a member of the Planning Board. He was a member of Alpha Lodge, A.F. & A.M. and Grace Congregational Church, he was a member and past president of the Kiwanis Club. He leaves his wife Elizabeth; a daughter Mrs. Lloyd Lenard of Shreveport, La.; 3 sons, Ralph H. Nangeelle, Idaho, Joseph N. of Hopkinton, and George D. of Framingham, a sister Mrs. Marion Marshall of Chesterfield, N.H. and eleven grandchildren."

W. B. (Pete) Newell wrote on the 51st Reunion postal, "Sorry we will be back home in Tampa, Fla., before then. After spending a couple of months in Europe, we arrived in Paris in June during a taxi strike, however, they had black market taxis. We are now in Kennebunkport, Maine." Then a letter dated Nov. 22nd to *Ray Brooks* from *Art Gilmore* brought the sad news of Pete's tragic death on October 25th. Quoting from a letter from Pete's daughter, "He and mother were driving south from Maine and had stopped in a motel in South Carolina for the night. It happened as they were crossing the road from the restaurant where they had dined to return to the Motel. It was a 35 mile per hour zone with yellow blinking lights. They had crossed to the middle of the road and mother seeing a car away down the road went ahead, but the car was speeding and thinking it would hit mother—which it would not have—the car went over into the middle of the road where Dad was standing and struck him. He died two hours later. I do not think he regained consciousness. Someone telephoned the police in Italy, who notified me. I flew

over with my little boy. The funeral was in Savannah, (the boy who struck Dad, tried to kill himself a few nights later)."

Wm. H. Seymour, 72, retired senior vice president of the Liberty Mutual Insurance Companies, died July 10, 1968, in Plymouth, Mass. after a long illness. He joined the Company as a field engineer in 1922. He was responsible for the building of the Hopkinton, Mass., Research Center and Rehabilitation Clinics in Boston and Chicago for Liberty. He became a resident vice president in 1936 in Chicago and a senior vice president in 1957. He retired in 1960. He is survived by his widow and two daughters.

From the letter box

G. Radcliffe (Rad) Stevens, 1006 Spring Street, Elgin, Ill., 60120 writes, "Since I fouled out on the 50th Reunion with that hernia operation the day you were parading down the aisle, things have been going along pretty good. I am still working full time and enjoying every bit of it. Golf is still my hobby, and I am going out this afternoon to play my 77th game this season—October 31—usually I get at least 100 games in, but we were away earlier this year. I took a flying business trip to Europe covering England and Germany for six days in May and upon my return Mrs. Stevens and I left on a four weeks cruise out of New York, through the canal to Lima and return. I sure do enjoy the notes in the *Review* and just wish more fellows would write in and tell us what they are doing as we never see anyone here in Elgin."

Edward V. Pollard's 51st Reunion return postal written by Ruth, his wife, "Ed had a stroke two years ago, is paralyzed and mute." Ed is no longer in Lynn and his address now is 8019 Keller Road, Cincinnati, Ohio, 45243. I am sure he would enjoy hearing from some of you fellows.

If anyone has not heard from *Ray Brooks* lately, it is because he has been hospitalized for over a month, returning home December 3. His comment; "I had so many hypos that mail did not interest me for awhile", is of the past.

Your secretary appreciates contributions to the Alumni Fund as the envelope flap entitled—News for your Class Secretary—brings some interesting items for the *Review*. Here is one from *Elmer L. Joslin*, 3 Bow Street, Concord, Mass.

"Not much to report. Last December, '67 Bertha and I celebrated our 50th wedding anniversary with our two children and five grandchildren, with an open house. That was the 2nd 50th during the year, the other of course being M.I.T. My time now is taken up mainly looking after five houses belonging to the First Parish in Concord, one of which is the Wright Traven of Revolutionary fame."

Leon Keach continues his architectural work and has an interesting commission for the Dartmouth 200th Anniversary this year. Plans are for a bronze door to be located in Dartmouth Hall.

Joseph Gargan, another golfer, of Chestnut Hill, Mass., did not make it to the 51st Reunion as his wife Bess, slipped on a rug and fell. Although no bones broken, she was laid up for sometime. Otherwise he pursues "one or two part time matters."

Robert Gannett of Englewood, N.J., "For the past two years have been working full time as financial secretary for a large local church, so being retired, has not posed any problems on what to do with my non-existent spare time."

David E. Waite, Bradford, R.I. missed the 51st Reunion at Sturbridge, Mass. "Taking a trip to celebrate 49th wedding anniversary. We are expecting our 4th grandchild in October, 1968." Dave also comes up with a resume. "Took research course V—first job Tyndel Morris Drop Forging—next research lab for a steel and wire concern in Worcester—followed by six years in Wickwire Spencer lab and foreman in heat treatment. On to Assistant Professor of Chemistry and Metallurgy. Next 35 years as lab superintendent on spiral springs and chief product engineer of Wallace Barnes Company—retired 1959."

Changes of address reported: Rear Admiral *Frederick G. Crisp*, PO Box 115 Saratoga, Calif., 95070. *Hartley B. Gardner*, 49 Amherst St., Auburn, Maine, 04210. *Philip Potash*, 55 Langdon St., Cambridge, Mass. 02138.

At the December '16-'17 monthly luncheon at the Chemists' Club in New York, Dr. Stratton honored us by his presence, having flown down from Boston for the meeting. In attendance were four '16er's and four '17er's. Besides *Clarence Seely*, *Dick Loengard*, and *Dix Proctor*, it was a pleasure to have *Ed Aldrin, Sr.*, present again.—*C. Dix Proctor*, Secretary, PO Box 336, Lincoln Park, N.J. 07035; *Stanley C. Dunning*, Assistant Secretary, 6 Jason Street, Arlington, Mass. 02174

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Many of you have not visited M.I.T. since undergraduate days and perhaps some impressions of one who resides across the river from campus will give you new perspective. In the first place it is big—much larger than you can visualize. The buildings surrounding the Great Court—our whole group then—form only the centre core for many more buildings standing east and west along the river a magnificent sight for you to behold in person rather than by photograph.

Physical size-impressive though it may be, this is secondary to the scope of the program. Many courses have been added to our fifteen in new and undreamed of (since 1918) disciplines of humanities, political science, nuclear science, nutrition and geophysics, to mention a few.

Another enlargement in the M.I.T. sphere of influence is the interest in continuing

education evidenced by the annual Alumni Seminars. Selma and I have attended all six of them since their inception in 1962. The format is a three-day week-end concentrated lecture series by prominent teachers (most of them from the M.I.T. faculty) dealing with important new approaches to and understanding of such problems as the "Urban Crisis", "The Origin of Life", and the most recent one "Computers in the Service of Society." These educational programs have been most stimulating and informative.

Letters from the two "Petes"

This year, however, held particular interest because during a lecture by Dean Pounds of the Sloan School of Management, two letters were read by him from two "Petes" of the Class of 1918. Imagine my excitement. I immediately obtained copies for my records and am now passing them on to you.

"Dear Dean Pounds: A recent circular states that you are to lecture at an Alumni Seminar about 'Computers in the Service of Society.' I wonder if you know of Professor Schell's work at Hog Island in 1918, which might be considered pioneering work in the development of modern computers.

"He was partially responsible for the installation of a Material Control System which kept track of the steel parts which were assembled from outside shippers in a steel storage yard and then assigned to the ships being constructed. I believe you might find a copy of a report he made about the system in his files.

"The report might be of interest because at that time Powers Tabulators, Hollereth Sorters, and punch cards were used. The cards were of the same material and size as those used now for computers but only had 45 columns with 10 digits. The tabulators were operated by reeds which dropped through the round holes punched in a card.

"Mr. Davidson from Buffalo had complete charge of the installation. He claimed then that in 5 years the machines would eliminate many bank clerks and would simplify clerical work throughout industry.

"In operation it was found that frequently a reed would stick in the holes of a card, and wrongly punched cards caused havoc. Many executives felt they should be able to obtain any information about steel they wanted even though the system was designed for limited purposes. Incorrectly punched cards, errors on freight bills of lading, and errors in filing caused many headaches.

"Besides myself, there were two other Tech men, now living, E. R. Harrall and Kenneth F. Woods, who were involved in the installation and who may be able to give added information. Yours sincerely, Peter M. Strang."

"Dear Mr. Pounds: Your inquiry regarding The Hog Island operation in 1918 comes like a voice from the long-forgotten past

and it is indeed just about 50 years since it all happened.

"My connection with the project was in truth very brief, since I had already taken the West Point exams and was about to receive my commission as a Lieutenant in the Corps of Engineers. Thus my sojourn at best was very short.

"As I remember the circumstances, the allocation of hull steel to the various shipways, 100 ways in all, had been on a helter-skelter basis, resulting in the most enterprising foremen getting the hard-to-get pieces first, and leaving all the ways in a state of uneven progress so far as turning out ships was concerned. Some ships were entirely built in the mid-sections and others had only bows and sterns finished.

"The solution was to have all received material put on Powers Punch cards each 24 hours, then tabulated as received, then sorted, by need for each ship, and then those particular parts released to the ways in strict rotation according to the best use of the available material. It resulted in a very orderly progression of ships and those that could be finished first came out that way.

"The equipment was new to use, and had plenty of bugs but considering all the circumstances, the results were adequate for the need. I recall it took lots of overtime hours at no increase in pay to work out all the features of the system. While we were not aware of it because of unfamiliarity with the equipment, it was probably a pioneer use of it for the specific use we made of it. Such a system with great refinements would probably be 'old hat' today.

"I know nothing of the 'report', since I left to enter the Army sometime in the spring. I trust the very little data herein may be helpful in some way. Very truly yours, E. R. Harrall."

The womenfolk

Several pictures of our 50th reunion were sent to some of the widows of classmates. If there are some who received these notes, but did not get the picture, I will be happy to forward one to you on request. Marguerite Wills and Louise Tucker sent me cordial notes which I herewith acknowledge. The most interesting and exciting letter, however, was from Blanche Hanley which I reproduce below. Our best to you and George from all of us of 1918.

"Dear Selma and Max: How like the two of you to order for an send to me the 50th Reunion picture. I am most appreciative. And how much the two of you did to make Wiano a happy time and place for me.

"I realize that this should be a handwritten note, but at the moment typing is a little better than writing, even though neither is up to par as I have not yet fully recovered from a dog bite on the inner right wrist on October 16. I am

definitely on the mend, but very small objects are impossible, certain positions and pressures; but given time those will again operate.

"I have one piece of what is for me very BIG news. I remarried on July 8th (but did not know whether it would happen at all until June 30th). George was my main beau my senior year, but things happened to bust it up, and I did not see him again until our 30th Reunion (1962); and he tends to be slow to make up his mind—both a good and a bad process. I worked thru until July 19th and joined him on the 20th in Canajoharie, where we have been since, and are on the verge of leaving. There is the possibility of a two-month job in Colombia with the International Executive Service Corps. As yet one more favor, do you have Jorge Pena-Polo's address? I have an idea he lives in Bogotá, and, while we would be in Baranquilla, I have an idea we might do a little extra touring of the country if we get there at all.

"I hope that the Class of '18 will continue me on its roster and that I may still attend the 55th. I'd even like to bring George along! That is what I think of the Class of '18. My very best to you both. Sincerely, Blanche (Mrs. George Parsons) formerly Mrs. Jack Hanley."

We continue with our most wonderful womenfolk—in this instance seasons greetings from *Gretchen Palmer*. She left December 21 for California and then to go on to Hawaii. She wants to see a real live volcano eruption. Let us hear from you on your return, and happy volcano hunting.

Early American

It is pleasant to record that good deeds live on after we are gone. Such a refreshing item recently was printed in the Boston *Herald Traveler* as follows: "Speaking of room set-ups and houses, there's a brand new book 'bout both that any devotee of colonial housing will want to have. It's 'More Houses for Good Living,' by Royal Barry Wills Associates—a sequel to 'Houses for Good Living,' written some years back by that master of Early American architecture, the late Royal Barry Wills.

"Amongst the 125 photographs and 60 drawings are interiors and exteriors of Royal Barry Wills' own houses, including the one which he built in what once was the rose garden of a Winchester estate and which is now occupied by his widow.

"The new book, published by Architectural Book Publishing Co., is written by the three Wills' associates—son Richard Wills, Robert E. Minot, and Warren J. Rohter.

"Dick Wills, who used to live in a remodeled barn in Hamilton, lives now in an 1870 townhouse on Mt. Vernon Square at the foot of Beacon Hill. Although nearly 100 years old, the house has the Wills' touch with the old-fashioned kitchen turned into a living kitchen, with

sitting-eating-working areas, the chopping block island counter on wheels, copper hooded barbecue built in the chimney that used to serve the old coal cooking stove. There's even a door leading to a tiny back terrace."

Fascinating stories

It is my purpose to acquaint all of you with the fascinating story of what many of us have done in our fifty years since graduation. In particular, these biographical sketches are much better published while we are alive, rather than as obituaries. *Albert C. Walker's* career speaks for itself and I know you will all share the vicarious pleasure of knowing he is a fellow classmate. I hope to follow in succeeding issues with more stories of what you have done in the last half century.

Albert C. Walker, of 77 Oakview Terrace, Short Hills, N.J., was a research engineer at the Bell Telephone Laboratories, Murray Hill, N.J., until his retirement in 1955. He was born in Denver, Colo., in 1893, and attended the University of Colorado from 1913 to 1916. He received his B.Sc. from M.I.T. in 1918, and his Ph.D. in chemistry from Yale University in 1923. He held research positions at the Clinton Wire Cloth Co., in Clinton, Mass.; the Eastern Mfg. Co., a paper mill, in Bangor, Maine; and the Winchester Repeating Arms Co., in New Haven Conn., before doing his graduate work at Yale. In 1923 he joined the technical staff of the Western Electric Company's Engineering Department in New York City, and in 1925 this organization became the Bell Telephone Laboratories.

During World War II he was engaged in growing ammonium dihydrogen phosphate (ADP) crystals for the sonar equipment used in detecting submarines. After the war this experience was employed in the development and operation of a pilot plant for growing ethylene diamine tartrate, (EDT) crystals for use as a substitute for quartz in telephone circuits. At the same time he was engaged in a research study on the growing of quartz crystals. Out of this work on quartz came the development of a useful, practical method of growing large, clear quartz crystals weighing more than one pound each.

Prior to World War II, Dr. Walker conducted research on homogeneous equilibrium in aqueous solutions; on the physical chemistry and electrical properties of textiles and fibers; and on precise humidity control and recording apparatus. This work led directly to the improvement of the electrical insulation resistance of cotton to equal that of silk so that 10 cents per pound cotton could be used in place of two dollars per pound cotton as insulation on central office wiring.

In a private laboratory at home he built the first American Pofarograph and used it to test for lead in urine and cancer by tests on blood sera.

Dr. Walker is the author of numerous publications on such subjects as electrical properties and moisture content of textiles; humidity control and measurement; wearing qualities of textiles; statistical quality control methods applied to the measurement of a variety of experimental research. In addition, he published a series of papers on the growing of crystals, one of which resulted in the award of the Louis Edward Levy Medal of the Franklin Institute in 1951. He was elected to honorary membership in the New York Medical-Surgical Club after giving a talk on crystals.

For some years he was a member of the advisory board of the Textile Research Institute, and as a director was primarily responsible for selecting the present site of this Institute at Princeton, N.J.

He is a member of the American Chemical Society, American Association for the Advancement of Science, American Institute of Chemists, Textile Research Institute, New England Association of Chemistry Teachers, American Geological Institute, New York Academy of Science, Professor Engineer of the State of New York, Alpha Chi Sigma, Sigma Phi Epsilon, Sigma Xi, Gamma Alpha, YMCA of Summit, N.J., and also a member of the Old Guard of Summit, and of Millburn, N.J. Has organized a group of 30 retired men who work for the New Eyes for the Needy in Millburn, N.J.

Changes of address

A note from *Phil Dinkins* indicates that he has moved to 315 South Lake Drive, Palm Beach, Fla. *Walter Biggar* has a new address, 298 Regency Park Drive, Agawam, Mass. 01001. *John Brailsin* can be reached at P.O. Box 303, Canton, Conn. 06019. *Howard Cyr's* new address is 1032 Circle Drive, Palmerton, Pa. 18071. *Charles F. Simpson* has moved to Apt. 207, 3232 South Macdill Avenue, Tampa, Fla. 33609. *David McFarland* now resides at 102 West Rosedale Avenue, West Chester, Pa.

Brief notes

I have a letter from *John Abrams* with an enclosure from "Packy" which I will include in next month's notes. Seasons greeting arrived from *Bob Grohe* from Deerfield, Ill., and from the *Ed Rossman's* from Paris Hill, Maine.

A clipping from the *Topeka State Journal* states the Topeka Art Guild sponsored in early November an exhibition of paintings by Pauline H. Shirer and photographs by classmate *Hampton F. Shirer*.

After graduation he gave up his main architectural pursuits when he became head of the Kansas Book Company, Inc. In 1953 he was invited to Boston to prepare working drawings of the National Shrine of the Immaculate Conception in Washington, D.C. This structure was dedicated in 1959. He is now retired, and with his wife has travelled throughout Europe and the western United States recording photographic impressions of these regions.

Clarence D. Hanscom reports a busy year again. He exhibited at a couple of antique shows, spent six weeks in Mexico, July in the hospital, more antique shows in September through November. Write use some details, Clarence.

Oldest married couple

Finally, an item from *Al Sawyer*, Ormond Beach, Fla. I quote, "My wife (Lillian) and I celebrated our 50th wedding anniversary August 26th. We are probably the oldest married couple in the world as our certificate states, August 20, 1819. The minister was a long retired replacement, and I surmise was still living in the 1800's." Congratulations from all of us, Lillian and Al, and our best wishes for many more years of good health and happiness together.

Once again, keep the news coming to me. I want more biographical sketches from you, and you, and you.—*Max Seltzer*, Secretary, 87 Ivy Street, Brookline, Mass. 02146

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Timothy Shea, retired Vice President of the Western Electric Company has been awarded the United States Navy's Distinguished Public Service Medal. This is the highest award that the Navy can give to a civilian. Presentation was made by Admiral Thomas H. Moorer, U.S.N., Chief of Naval Operations. Mr. Shea has been Chairman of the Undersea Warfare Committee of the National Academy of Sciences since 1964. In 1946 Mr. Shea was awarded the Presidential Medal of Merit for exceptional service to the Submarine Forces of the Navy. Part of the citation reads "The committee made notable contributions in the areas of Antisubmarine Warfare Surveillance Systems, Energy Sources, Submarine Noise, Satellite Applications and the structure and management of the Navy's Research and Development Program."

In brief

A. S. Barnes & Co., have just published a book by *Harry Kuljian* entitled *Nuclear Power Plant Design*. The book is directed toward engineers and students who have a practical knowledge of conventional thermal power plant design, but who are not as familiar with nuclear reactor system engineering.

George Irwin, retired Lieutenant Colonel, U.S. Army, lives in Delray Beach where he has been since 1955. He and his wife play golf three times a week. He has 21 grandchildren. He attended the 1967 Orlando M.I.T. meetings.

Louis Grayson is still active in his insurance brokerage business, but takes time to do a lot of travelling. Last spring he and his wife spent over two weeks in Jamaica and the American Virgin Islands. This fall, they were in Europe for several weeks and visited Yugoslavia, Hungary, Austria and Germany.



Harry A. Kuljian, '19 (far left); Willard W. Frymoyer, '21 (left center) and Samuel E. Lunden, '21 (near left).

©Fabian Bachrach

Jack Stevens and his wife have bought a home near Delray Beach on the property of the Country Club of Florida. Jack is making a splendid recovery from a serious operation and except for a trip north for the holidays, will be in Florida until April.

Although retired, Richard Holmgren, is doing some private consulting practice on civil projects. He has just returned from three months in Europe, using a Volkswagen Campmobile for camping in Finland, Vienna, Austria, and Switzerland.

Before his retirement in 1962, Huron D. Corthell spent many years as a building contractor and as a carpenter foreman. He worked on the construction of the Golden Gate Bridge as Assistant Superintendent, Peace River Bridge and Tacoma Narrows Bridge.

Classmates deceased

We are sorry to report the death of Harry P. Azadian, of Allston, Mass., on January 28, 1967; and of Alfred A. Johns, of New Port Richey, Fla., on June 1, 1968.

50th reunion

When these notes are read by our Class, there will remain about four months before we gather to celebrate our 50th reunion. Your secretary urges you all to make plans for this very important get-together with old classmates. Already the following have indicated they are coming: the Sorensons, Dotens, Michelsons, Spooners, D. C. Halls, Smoleys, Bristols, Flynn, Houghs, Saunders's, Ways, Patersons, Ark Richards's, Stevens's, Burbanks, Sheelines, Websters, Byles, Seifert, Loucks, Moodys, Graysons, Reynolds, Wiswall, Hunter, Stewarts, Langilles. This was as of October 1, 1968, and totals 50 with 26 others who indicated they'd decide later. Let Will Langille know you are coming and send your M.I.T. class gift contribution to Paul Sheeline.

The anniversary begins on Thursday, June 12th at 5:30 p.m. We stay overnight in Cambridge at McCormack Hall. There is an informal reception and buffet dinner that night. On Friday, June 13, commencement exercises and luncheon in Cambridge before we leave for the

Chatham Bars Inn at Chatham on Cape Cod. We stay at the inn until noon on Sunday when we drive back to McCormack Hall. That evening at 5:30 p.m. there is a reception for members of 1919 at President Johnson's home. On Monday, the class gift will be presented at luncheon in Rockwell Cage. Dinner at Rockwell Cage and entertainment in the evening at Kresge Auditorium. Breakfast on Tuesday morning at McCormack Hall and then back to our respective homes. Do not miss this important event—landmark of our trip through life, tying in our great undergraduate days at M.I.T.—Eugene R. Smoley, Secretary, 111 Casuarina Road, Delray Beach, Fla. 33444 (until March 15th). Phone 305-278-4537

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Congratulations are in order for Frank Maconi who was married early in October to Mrs. Marjorie Whitney, of Ellsworth Falls, Maine. Frank reports that he now has seven grandchildren, his three plus his bride's four. Frank continues active at Babson's Reports in Wellesley as Investment Advisor as well as running his Early American country store antique collection. We advise classmates as well as the other M.I.T. men to take a look at this interesting enterprise. Mac resides at 133 State Street, Framingham, Mass. When last seen he looked as young, handsome and full of pep as ever and the above news bears this out.

Good news for us all, is the word from Norris Abbott that Ed Burdell has graciously consented to serve as eulogist at the M.I.T. Memorial Service on June 15, 1970. We cannot imagine anyone better qualified than the distinguished Dr. Burdell. Ed reports that he is in good health and is keeping very busy in a number of community projects as well as doing consulting work for several educational institutions both in this country and in the Middle East. He now holds forth at 521 Dommerich Drive, Maitland, Fla.

Where they are

I believe I reported Archie Kinghorn's location as Berkeley, Calif., last month. His full address is 2634 Virginia Street.

Ben Hopkins' address is Apt. 202, 295 Kendale Avenue, Toledo, Ohio. Ken Newhall may be found at 25 Rock Avenue, Swampscott, Mass. Commander Heinie Haskell still resides in Moosup, Conn., 60 High Street, unquestionably the leading citizen of that area.

Classmates deceased

We have just received word that Charles W. Eaton of Stevens Lane, Cohasset, died early last summer. No details.

Present at the initial meeting of the new Alumni Advisory Council were: Ed Ryer, Al Burke, and Perk Bugbee, as well as your secretary. It is pleasing to report that these class stalwarts appeared to be in the best of health and spirits. Ed is by now basking in the sunshine of Naples, Fla., where so many retired men of M.I.T. seek refuge from New England's wintry winds.—Harold Bugbee, Secretary, 21 Everell Road, Winchester, Mass. 01890

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Last call for the '21 Interim Reunion in Mexico—March 13 to 15—at the twenty-first annual Fiesta of the M.I.T. Club of Mexico City. Advise either Al Lloyd or Ed Dubé of our Committee (at the addresses listed at the end of this news) and then make your arrangements for staying in Mexico, D.F., and also for touring the fascinating country either before or after the Fiesta. Club President Armando Santacruz B., '54, has confirmed the events of the tentative program published last month, with minor revisions in their order, except for Friday morning. On that day, the entire group will be taken north of Mexico City to the gorgeous sixteenth century seminary at Tepotzotlan, now a huge show place for three centuries of art and antiques.

The Noche Mexicana, climaxing the celebration, will again be held in the beautiful gardens surrounding the home of Don Federico Tamm in San Angel, a home that was once a sixteenth century Spanish colonial convent. This night alone warrants your making the trip. Details of the entire program can be obtained from Al, Ed or your Secretary. Reservations have already been made by Anne and Wally Adams, Elizabeth and

John Barriger, Becky and Elmer Campbell, Maxine and Cac Clarke, Theona and Al Genaske, Alex and Munnies Hawes, Emma and Al Lloyd, Mildred and Jack McCloskey, Elma and John Mattson, Kim and Don Morse and Helen and Ray St. Laurent. As previously noted, our distinguished honorary classmate, President Howard W. Johnson will deliver an important address. He and Mrs. Johnson are the guests of honor. Louise and Jack Giles and Clara and Asher Cohen have indicated they may also attend and more reservations are coming in at the date these words are written from other couples who attended the '21 reunions in Mexico in 1960 and 1967 and who are expected to join the group again this year. Make yours now. Get away from cold March weather. Don't miss this unusually good time.

Thankful for good cheer

We want to express heartfelt thanks to the many who have visited, phoned and written to Helen and Ray St. Laurent during his recuperation from a serious operation. The list is long and we know that Ray would wish us to tell each one how much he appreciates what you did to ease the tension with words of cheer. We have been in constant touch with Helen and Ray and are most happy to report he is progressing rapidly. Please continue to let him hear from you at his home, 47 Gerard St., Manchester, Conn. 06040, where the telephone is 203 643-6056. By all means, see him if you are nearby. We, too, have been deluged with phone calls and letters inquiring about Ray's condition and heartily welcome your sincere interest and, of course, your own news. You certainly are grand friends and your instant response is characteristic of the strong bonds which have held our Class together throughout the years.

Elected A.E.A. president

Coming back to Mexico, we extend heartfelt congratulations to Manuel Sandoval Vallarta on his election in Vienna last fall as president of the International Atomic Energy Agency. The honor was conferred upon Val at the 12th general conference of the agency. One of the three members of Mexico's *Comision Nacional de Energia Nuclear*, his headquarters are located at Insurgentes Sur 1079, Tercer Piso, Mexico 18, D. F. He was recently in Madrid to chair the agency's symposium on nuclear desalination, at which various projects for providing water and power were discussed, including one near the Gulf of California to help meet future needs of adjacent regions in Mexico and the U.S.A.

The romance is gone

Writing from his office at 602 First Savings Bldg., San Angelo, Texas 76901, John M. Giles says he will travel to South Africa and then via the Libyan Desert to visit a relative who is a geologist in Tripoli. He is eloquent about Guadalajara and Mazatlan in Mexico. "Came back by railroad from Topolambampa to Chihuahua. They were building the railroad

when I first came to San Angelo. It was completed from Ft. Stockton to Presidio on the Rio Grande by 1930; to Chihuahua in the forties, and the link from there down the west side of the Cordilleras a couple of years ago. I see Bob Waterman when I go east in the summer. Spend most of my time traveling, mostly to Europe. Sorry I missed the last two '21 reunions; I was in the hospital both times for operations. I don't enjoy forced retirement. Looking for oil is too strenuous after two heart attacks. Since I can't complete my own wells the romance is gone. There is no thrill in buying an interest and letting someone else supervise the drilling and completion." Jack says he and Louise visited Banff and Victoria, B.C., last summer and we hope they will decide to join with us in Mexico.

Congratulations

Two Class of '21 families are receiving congratulations on the arrival of grandson Thomas Pingree Wheatland last October 25 to David and Susan Wheatland of Brunswick, Maine, where David is professor of inorganic chemistry at Bowdoin. The happy grandparents are Laurie and Chick Kurth of Boston and Elizabeth and David Wheatland.

A depressing experience

Chick sent a long letter, written on board the *M. S. Sagafjord* last summer during a forty-four-day cruise to Scandinavia, Russia, Germany, Holland, Belgium, Ireland and Scotland. He and Laurie have already visited 47 of our 50 states and plan to see Oregon, Washington and Alaska this year. Chick's "retirement" activity is a consulting association with Jackson and Moreland International. Early last year, he was in Puerto Rico to aid the local power authority to develop an improved maintenance program for power plant equipment. Still earlier, he had been a member of a team making an engineering audit of a 60,000 kw power plant being built by the Andhra Pradesh Power Authority at Ramagundam, India. Chick reports he went to New Delhi, Hyderabad, Bombay and the plant site to meet with various officials and cut through "red tape." He adds: "It was quite an experience, with long flights, time zone changes, unusual food, strange accommodations and customs. We took an extra 200-mile auto trip to see the Taj Mahal. The people problem in India is terrific, with serious health and nutritional matters still unsolved. My general reaction was one of great need of leadership to resolve deficiencies, principally in the economy, unemployment, elementary sanitation and food production. A startling fact is that industry, agriculture and civil works are retarded by the use of primitive work methods while 40,000 engineering graduates remain unemployed. The trip was a most depressing experience." For a year, Chick represented the Saudi Arabian government on a new power and desalting plant at Jeddah. He tells us that Joe Kaufman, 923 Essex Rd., Daytona Beach, Fla. 32017, lost his wife after a long illness and we hasten to

express sincerest sympathy to Joe and his son.

Clarke accomplishments

The Review received the following from Edwin T. Steffian.

"As assistant Secretary of the Class of 1921, I am submitting the item below for inclusion in the next issue of the Review.

"Knowing the inherent modesty of our distinguished Class Secretary, Carole Clarke, your assistant Secretary notes that his well known book 'Handbook of Electronic Instruments and Measurement Techniques' has just gone into its third printing by McGraw Hill.

"Cac's literary efforts, however, are not the only Clarke accomplishments. A recent Asbury Park Press notice praises Maxine's artistic activities. In particular it refers to a recent unveiling of a mural in the Brielle Public Library. Its title is 'Discovery' and it is intended for the children's section of the library. I quote, in part, from the piece. 'Mrs. Clarke has a studio attached to her home on Union Lane opposite the library where her mural is now. From that studio comes a steady flow of portraits, landscapes and sketches . . . and in both output and style there is little similarity to the efforts of a 'suburban housewife.' "

In brief

A happy note from Emma and Al Lloyd, 35 Spruce St., Westerly, R. I. 02891, says: "November 18, 1968, was the eventful day that Susan Lloyd Hayes arrived to bless the home of our daughter and Dr. Samuel L. Hayes, 3d, in New York City. This is the second daughter for the Hayes family and our fifth grandchild, all girls. Needless to say, both sets of grandparents are very pleased." . . . From his home at Norway Hill, Hancock, N.H. 03449, William Rose, Jr., writes: "Thanks for letting me know about Saint. My latest word is that his operation has been successful and the prognosis good."

John G. Lee, Old Mountain Rd., Farmington, Conn. 06032, writes: "I retired in 1964 as Director of Research, United Aircraft Company, and am now vice chairman of the University of Hartford and a member of the Connecticut Research Commission and several civic organizations in this area. My recreation, when time permits, is painting." . . . Albert S. Genaske, 138 Main St., Fryeburg, Maine 04037, sent a note from his summer home on Kezar Lake, Maine, where he and Theona remained through October. Al adds: "Have had a couple of nice get-togethers with Helen and Ray St. Laurent and Becky and Elmer Campbell here in Lovell. My daughter, Marion S. Robbins, presented us with her second daughter, Katherine Gail, on September 9." . . . Webster K. Ramsey wrote that he spent last summer at West Falmouth, Mass. As a sequel to the note we

published from *Robert W. Haskel* in last month's *Review*, Web promises: "When I get home to 18 Damon Rd., Holden, Mass 01520, I will give you a write-up concerning the first 'Open House' at M.I.T., engineered by Bob Haskel and me in 1921, endorsed by Professor Edward F. Miller and enjoyed by most of the members of the American Society of Mechanical Engineers in the Boston area." This is a reminder to Web that we are anxiously awaiting his manuscript and the return of that personal data form for the class records. . . . *Philip H. Hatch*, 70 Gibson St., North East, Pa. 16428, reports: "In company with John D. Bowman, '20, and his wife, Mrs. Hatch and I took a round-the-world cruise last winter on the *S.S. Rotterdam*. It was most interesting and enjoyable."

Roy J. Roy has retired as district manager of the Allen-Bradley Company in Cleveland and has moved from Rocky River, Ohio, to a new home at 1408 California Park, Lexington, Ky. 40502. . . . *Ralph H. Wallace* reports his retirement as general traffic engineer of the New England Telephone and Telegraph Co., Boston. He can now be reached by writing to Box 11, Deltona, Fla. 32763. . . . *Aaron A. Tushin*, formerly with the U.S. Patent Office, now lives at 4 Riverside St., Wheelers Point, Gloucester, Mass. 01930. . . . *Edward M. Richardson*, a former owner of Morning Glory Cabins, Hampton, N.H., says he now receives mail via R.D. No. 1, Saylorsburg, Pa. 18353. . . . *Robert R. Whitehouse* has retired from ownership of the Maplewood Lumber Co., Unity, Maine, and lives at 633 70th Ave., St. Petersburg Beach, Fla. 33706. . . . *Richard J. Spitz*, former vice president of Newport Industries, Inc., New York City, has retired to 100 Sands Point Rd., Sarasota, Fla. 33577. . . . *Marion and George Chutter* are celebrating the arrival of their fifth grandchild, Kristin Beth, born last August 23 to their youngest son, Roger, and his wife, Karen. Roger is a registered representative with Goodbody and Co., Detroit. Raymond, the Chutter's oldest son, has been with Procter and Gamble, Cincinnati, since his graduation from Lehigh in 1949. He and Janice have two sons.

Elected senior vice president

Willard W. Frymoyer, 43 Granite St., Foxboro, Mass. 02035, who started the research and development department of the Foxboro Company in 1926, has been elected senior vice president. During his long career with Foxboro, Fry has served as director of research, factory manager and executive vice president. He has been a director since 1957 and, for the last four years, he has had charge of corporate planning as a member of the company's executive committee. A member of the Glee Club during our undergraduate days, he spent five years developing military aircraft flight instruments at the Bureau of Standards following graduation in Course II. In a personal note, he says: "When I joined Foxboro, its annual sales

were in excess of \$1 million, with some export business. We now supply process industries with a line of instruments for measurement and control of whatever variables can be measured as well as complete control systems, affording full process control management, including the use of computers. Worldwide sales exceed \$125 million from plants in the U.S., Canada, England, Holland, France, Mexico, Australia and from associates in Japan. It is a business which meets a daily challenge of new problems, new opportunities and new vistas. Competition is stiff and the pace of innovation increasingly rapid. My wife and I have spent much time traveling. Our last trip carried us to Hawaii, Tahiti, New Zealand, Australia and Japan. I am planning to retire this year, to devote more time to travel, community service and to our family. We hope to attend the 50th Reunion." Fry and Elizabeth, Mt. Holyoke, '23, have a married daughter, Mary, Mt. Holyoke, '54; two married sons, William, Amherst, '55, and John, Amherst, '59, with an M.D. from Rochester; and eight grandchildren.

First prize

Samuel E. Lunden, a member of our famous group of West Coast architects and partner in the architectural and planning firm of Samuel E. Lunden, F.A.I.A., and Joseph L. Johnson, A.I.A., 453 S. Spring St., Los Angeles, Calif. 90031, is the author of "Inhalation Therapy Department: Physical Facilities," appearing in the September, 1968, issue of *Hospitals*, the journal of the American Hospital Association. One of the firm's specialties has been the design of hospitals and medical facilities and it won an A.H.A. first prize for planning a community hospital and health center. In the current article, Sam presents guidelines for facilities and layouts applicable to both large and small hospitals and additionally covers recommended features when the department is or is not coordinated with other related hospital services, such as a cardiorespiratory area. His organization designed the Health Administration Building in the Los Angeles Civic Center, the Veterans Administration Complex, Phoenix, Ariz., the Hospital of the Good Samaritan Medical Center, Los Angeles, and its Bishop Stevens Memorial Wing, radiation therapy suite, cobalt treatment unit, intensive care and coronary care units. Sam is a past national vice president, a past president of the California Chapter and a Fellow of the American Institute of Architects and recipient of its Edward C. Kemper Award for significant contributions to the A.I.A. and to the architectural profession. He has invented an electrically conductive pad system for use in hospital operating rooms to eliminate hazardous static charges and also researched and developed a conductive ceramic tile for surgical area floors, which was the forerunner of the tile now in general use. His civic activities include membership on the board of governors, past presidency and chairmanship of regional

planning of Town Hall of Los Angeles, which gave him its Town Hall Special Award in 1960.

Active on various committees of the Chamber of Commerce, he was also appointed by the mayor as vice chairman of the Los Angeles Citizens Traffic and Transportation Committee and is now a member of the Citizens Advisory Council on Public Transportation. He was planning commissioner, City of Manhattan Beach, secretary of the South Bay Beach and Highway Association, a member of the Southern California Planning Congress and chairman of the site planning committee of the Housing Research Council of Southern California. His memberships include the American Hospital Association, Commonwealth Club, the Central City Association and its Downtown Development Committee. He has written numerous articles on architectural and transportation specialties and is the author of a book, *Community Development through an Exposition for Los Angeles*, published in 1944 by the Haynes Foundation. He is a past president and life member of the Board of Governors of the M.I.T. Club of Southern California. He serves the administration of M.I.T. as a member of the important Corporation Development Committee and of the Amity Fund Board. For his own area, he is an Honorary Secretary of M.I.T. and a member of the Regional Council of the Amity Fund. He has been signally recognized by the Alumni Association with its highest award, the Bronze Beaver. He and Leila have done extensive traveling in Europe and in Mexico. Last year, he attended the Soviet-American Architects Symposium and they toured Russia, Hungary and Austria.

Keeping busy

Writing from his home, Apt. 1A, 3505 Langrehr Rd., Baltimore, Md. 21207, *Asher Z. Cohen*, Colonel, U.S.A., retired, says: "Sorry to have failed to inform you when we returned to Baltimore. Our temporary stay in Florida was to determine whether we would decide to make it our permanent home. Unfortunately, our plans did not materialize. Clara became ill about a month after we arrived and failed to respond to medical treatment. I decided to return to Baltimore and consult our family physician. He diagnosed the problem as brought on by the humid Florida climate. The diagnosis must be correct because she is fine now. He advised us not to move to Florida. My plans are rather fluid at this time. I have been doing volunteer work for the Small Business Administration. I ran into a number of interesting and challenging cases and have managed to keep busy."

Maxine and your Secretary had a delightful visit for several days with Maida and *Ed Dubé* at their very comfortable home in Reading, Mass. We attended several functions at M.I.T. and also enjoyed an extensive trip to Cape Cod. High spot was a thorough inspection of the gorgeous collection of thousands

of items of Sandwich glass at the most attractive museum in Sandwich, where we succeeded in obtaining rather good photographs of about 20 of the unusual window displays. Our hosts introduced us to the excellent cuisine of the nearby Daniel Webster Inn, which claims to be the oldest on the Cape. Back in New Jersey, we traveled the many miles north to the Orange Lawn Tennis Club for the dinner meeting of the M.I.T. Club of Northern New Jersey to welcome, along with *Sumner Hayward* and *Joe Wenick*, the excellent speaker of the evening, Dean Robert Alberty of the M.I.T. School of Science, and honored guest from Cambridge, Donald P. Severance, '38, Executive Vice President of the Alumni Association.

Augustus B. Kinzel, retired vice president for research of Union Carbide Corp. and retired president of the Salk Institute for Biological Studies, was one of the principal speakers at the International Engineering Conference at the University of Pittsburgh last October. Since engineers cooperate with natural scientists as well as with political scientists and economists on diverse national and international developments, the participation of 60 of the world's leading economists and scientists was directed toward analyzing the application of engineering technology to help the developing nations industrialize. M.I.T. was represented along with industry, governmental and international agencies in discussing the role of each.

In a hurry to get home

Accompanied by stamps from Israel and Greece, Marge and Jack Kendall sent us a letter from Athens: "This is a postscript to a letter we've just sent to Helen and Ray St. Laurent in answer to their letter forwarded to us in Jerusalem. I've asked Ray to send it to you. (We'll run it in a later issue—Cac.) We have just completed a tour of rural and antique Greece; have fallen in love with this country and hope to return some time when we visit the balance of the Mediterranean. Have ridden elephant and camel. Have washed our hands in the Ganges, Nile, Mediterranean, Bosphorus, Dead Sea and in Gallilee. Sorry, we are anxious to get home and won't stay in New York but we'll phone you from the airport before we take off for Dana Kepner's home, 82 Jasmine St., Denver, Colo. 80220, and a visit to our Jack, Jr., and his family in Salt Lake City enroute home." Since we were to be on a trip away from Brielle when Marge and Jack arrived, we succeeded in getting a message to them about Ray. Jack and Dana both phoned us from Denver to say that each had talked to Ray in the hospital. Jack has since written of their safe arrival at their home, 401 Hermosa Pl., South Pasadena, Calif. 91030.

The letter box

It is with particularly heavy heart that we received the following letter from *Eric Smith*, 78 Dufferin Rd., Montreal 254, P.Q., Canada. On its arrival, we phoned

Eric to express deepest sympathy from all of us in the Class and especially from the three couples—Emma and Al Lloyd, Anne and Wally Adams and Maxine and Cac Clarke—who were together so much with Muriel and Eric in Mexico during our interim reunion there in 1967. Eric writes, in part: "We spent last March and April wandering around Florida and, after we came home, Muriel was feeling very weak and tired. She went to the hospital and died on November 24. I was thankful that she was not in pain and never lost her good spirits. She was just terribly tired and lost her strength completely. Our near neighbor, A. D. Ross, '22, was not feeling too well for a couple of months. He died on November 16. So this has been a very unhappy year for your Montreal friends." Please write to Eric.

A letter has just arrived from Graciela and Helier Rodríguez which we will include in next month's news. It does give their new address, if you wish to send them a message of welcome, Mail it to Mr. and Mrs. A. H. Rodríguez, Apt. 10-C, 4015 Bayshore Blvd., Tampa, Fla. 33611, or phone them at 813 832-8971. We acknowledge their phone call about Ray St. Laurent.

A story in last October's *Holiday* magazine, entitled "Down the Big Ditch—the Inland Waterway," tells of a trip to Florida via the Intracoastal Waterway, starting with a rough ocean passage from New York City to the northern terminus of the waterway on the Manasquan River, near your Secretary's home. The article continues: "Outside the breakwater (Manasquan Inlet) all was turmoil; lurchings, poundings, slidings and laying over. Inside all was peace, sunshine, flowers, the laughter of little children, Mother, and a town called Brielle, New Jersey, population 2,619. What a lovely town!" Come visit us and see for yourself—by land, if not by sea.—Carole A. Clarke, Secretary, 608 Union Lane, Brielle, N.J. 08730; Edwin T. Steffian, Assistant Secretary, Steffian, & Bradley, Inc., 19 Temple Place, Boston, Mass. 02111; Sumner Hayward, Assistant Secretary, 224 Richards Roads, Ridgewood, N.J. 07450; Leon A. Lloyd, Chairman, Interim Reunion Committee, 35 Spruce Street, Westerly, R.I. 02891; Edouard N. Dubé, Co-Chairman, Interim Reunion Committee, 216 Woburn Street, Reading, Mass. 01867

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Since we are writing in the Christmas Season amid warmth and sunshine in Buffalo and skiing on the slopes twenty miles south of here, you are all forgiven for not having written more news in 1968. But that doesn't go for 1969 or any part thereof! So let's keep those cards and letters coming! Francis M. Kurtz of Delray Beach is our star performer. Frank writes about his tennis, bridge and socializing in Florida as well as being

treasurer of the local Playhouse. Frank and Carlys contemplated a visit from their South American son and two granddaughters for Christmas. Frank has visited with Harry and Conchita (Lobdell) Pearson who sold him on the M.I.T. Fiesta in Mexico City. Present at their Florida cocktail party last Fall were Harry and Bebe Rockefeller, John and Billy Church, Ross and Billy Wiggs and Ted and Mary Riegel from next door. Also present were Al and Charlotte Shaughnessy of the Class of '21 and Gene and Frances Smoley of the Class of '19. From the Class of '23 were Walter and Elsie Dietz and Fritz and Helen Clement. Several of this group hope to go to the Fiesta.

Theodore T. Miller has been elected to the Board of Directors of Lowell Industries, Inc., a subsidiary of Livermore Corporation. Ted should be at home in their manufacturing and marketing of ultra-high density plastic polymers for industrial use and vibrating damping pads and mounts for machinery installation. Ted also is a consultant to a number of United States and European companies in the field of chemicals, plastics and synthetic fibres. Paul J. Choquette retired in 1965 from the G.A.F. Corporation. He is currently a consultant after contributing to progress in the dyeing and finishing of textiles through the publication of technical papers. Paul has three sons and five grandchildren and is delighted with his work as an M.I.T. educational counsellor for White Plains, N.Y. His third son is a First Lieutenant U.S.A. now in Vietnam. Our apologies have previously been written to Dr. John W. Strieder but we continue to hear of his progress and active practice of Thoracic Surgery.

Lawrence Washington is still going strong as an aerospace engineer with N.A.S.A., Ames Research Center, Moffett Field, Calif., and plans to keep working until 1978. In the meantime, he will attend our 50th reunion. He has one daughter and three grandchildren. Ronald G. Macdonald has retired as Executive Secretary of the Paper Technology Foundation, Inc., Western Michigan University in Kalamazoo and has joined the editorial staff of *Southern Pulp and Paper Manufacturer* published in Atlanta, Ga. He continues as editor for the Joint Text Book Committee of the paper industry of the U.S. and Canada. He now lives in Jackson Heights, N.Y. Edward J. O'Connor, President of the Granite State Asphalt Co., of Manchester, N.H., has just retired as regional director of the National Asphalt Pavement Association. The seasonal nature of his business allows winters in Florida near Delray or visits to Hawaii where his daughter lives. He has two boys in the construction machinery business and is proud of his twelve grandchildren. He lives at 45 Clark Road, Andover, Mass.

We have learned that Edward C. Keane is one of the directors and has an active interest as Vice President of Fay,

Spofford and Thorndike, Inc., of Boston. *Frederick A. Higgins* has retired as President and Treasurer of Central Construction Co., of Lawrence, Mass., and keeps busy as a member of the Board of the Arlington Trust Company. He is also very active in developing Lawrence Industrial Park. *Dale D. Spoor*, of Richmond, Va., is continuing his happy exhortations to support the M.I.T. Alumni Fund. Please help him raise our Class participation from 46 per cent to over 50 per cent to gain silver and gold stars for his already well decorated crown. Dale is ready to provide a "genuine personal thank-you" for your gift. The M.I.T. staff has asked for a copy of the 25th reunion biography from each Class. If you can help, call or write Arnold H. Singal at the Institute.

John L. Vaupel has moved to East Road, Barters Island, Boothbay, Maine. He writes: "I have a place along the water where the Atlantic Ocean can cool me in summer. I can go to North Carolina when it gets too darn cold—not so in Buffalo where I lived on Delaware Ave., but I had a lot of fun there. Decided to call it off the end of this year and devote my time to sailing, fishing, bridge and general laziness." Thank you, John. We can certify that Boothbay in September is especially delightful.

Classmates deceased

We are sorry to record the deaths of several classmates and send the sympathy of our group to the families of: *Maurice W. Williams*, Castine, Maine; *George A. Watt*, Orange, California.

We note that *Tom West* has retired from the presidency of The Draper Corp. of Hopedale, Mass. three years ago and retired this last year as a member of the Alumni Fund Board. His final year on the Board he was given the 1968 M.I.T. Alumni Fund Staff Award for "outstanding performance over and above the call of duty." He and his wife Priscilla divide their time between an apartment at 70 Mt. Vernon Road, Boston and their permanent home in South Dartmouth, Mass.

Changes of address

Among the changes of address are those of: *Samuel H. Reynolds*, Madison, Conn.; *W. Ryland Scott*, Santa Barbara, Calif.; *C. William Perkins*, Fort Lauderdale, Fla.; *John G. Campbell*, Southbury, Conn.; *Dr. Mildred Allen*, South Hadley, Mass.; *Harold H. Spengler*, Cleveland Heights, Ohio; *James B. Spratley*, Mechanicsville, Va.

As you read these notes in Florida or other February vacation spots, your secretary hopes to be in Arizona trying to keep cool during the day and warm at night. We all suffer, don't we?—*Whitworth Ferguson*, Secretary, 333 Ellicott Street, Buffalo, N.Y. 14203; *Oscar Horovitz*, Assistant Secretary, 33 Island Street, Boston, Mass. 02119

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By the time you read this column you should have made your room reservation for the 21st Annual Fiesta in Mexico City scheduled for March 12-16 of this year. Although some 43 indicated interest there is always some shrinkage and the allotment of 36 rooms may not have been filled. Suggest you try anyway if interested by writing Mexico Transworld Tours, Gante 9-301, Mexico 1 D.F., Mexico. The M.I.T. Club of Mexico City has planned a good program of tours etc. at \$60.00 per person. Write to Clarence Cornish, 257 Margaritas, Mexico 20 D.F., Mexico for details.

On the news side we are doing much better this time. However most of it comes in the form of news clippings. Why can we not get more of this from you directly? Much less delay will occur and the news then will have a much more personal flavor. Please stop holding your lights under bushels. Let them shine in our direction please!

A letter and announcement

Howard Russell writes: "On December 4, 1968, Dr. *Nathaniel H. Frank*, Professor Emeritus of Physics was the guest speaker at the meeting of the New Hampshire M.I.T. Club held at the Holiday Inn in Manchester. His subject, 'Occupational and Career Obligations of Public Education' aroused more interest and generated more discussion than had been seen at the Club in years. It is Ned's opinion that public education, in spite of the tremendous sums of money being spent, is not doing the job it should be doing or is capable of doing." Howie also is delighted to announce that *Herb Hayden* has agreed to take on the job of Class Agent. Herb will of course do a great job and will relieve *George Johnson* of some of the duties he is performing so well. We also hear that Herb and his wife have been having a bout with the Hong Kong flu. There is a lot of this around. We hope you are now getting over it without too much pain. Anyway, your Secretary is pleased that the Class Roster is now complete on the official side which enables us to get out the new letterhead soon.

In the news

Earle A. Griswold, retired Executive Vice President and a founder of Tampax, Inc., was recently named Trustee Emeritus of the American International College. We learned that Earle had served on their Board of Trustees since 1962 and during that period served as Vice-Chairman and Chairman of their building and grounds committee during the most active period when 10 new buildings were erected. Earle is unique in that during the 83 year history of A.I.C. only two other men have attained emeritus rank as trustees.

Noted columnist Drew Pearson tells us that *Alfred E. Perlman* has made history in proposing in a recent speech at

Syracuse University that railroads be permitted to merge with other forms of transportation in the interest of the public good, efficiency and financial solvency. It makes good sense to us since we have all seen what has happened to a number of railroads due to over-regulation, technological changes of other forms of transport and the growth of uninhibited personal auto travel. Alfred is, of course, President of the new Penn-Central merged lines and has just received an award for outstanding achievement in the transportation industry.

We learn also that *Robert L. Hershey*, former Vice President of DuPont spoke at a recent meeting of the American Chemical Society, on "The Goals and Strategies of Industrial Research."

Ping Y. Tang, Chief Executive Officer of the South Sea Textile Manufacturing Company Ltd., Hong Kong, conducted a round table meeting in New York on "Trade and Industrial Problems of East Asia." After graduation from the Institute with our class he returned to China to become Managing Director of Ching Foong Cotton Manufacturing Company Ltd. In 1948 he moved to Hong Kong where he organized the company of which he is now the head. It is indeed great to hear about the success of one of our former "foreign students."

Aren Lier, Chief Structural Engineer for the Port of New York Authority, received an award of \$1000 for his paper entered in the 1968 James F. Lincoln Arc Welding Award Program for Progress in the Engineering Design of Arc Welded Structures.

Quickies

Another source of information, the M.I.T. Alumni Fund, provides us with more nuggets. *Franklin G. Clement* reports: "Retired four years ago. Spend most of my time in Florida. Play a lot of golf . . . have eight grandchildren. Sorry we could not make the 45th reunion . . . hope to make the 50th." *Columbus E. Lord* tells us ". . . my apologies and regrets that I was unable to support and attend the reunion events. . . as a last minute thought I telephoned *Clarence Chamberlain* . . . and while waiting for him to come to the phone, I heard the banqueters singing the Star Spangled Banner. . . I commented that I did not think the class singing had improved much in the last 45 years. Perhaps I can join in the singing at the 50th reunion."

O. W. Lowry tells us that he retired as president from the Sligh-Lowry Furniture Company in March 1968 and now has consultant status. *Milton E. Parker* tells us about the new words he learned at the recent Alumni Seminar on "Computer Impact." One is "GIGO" (Garbage in, Garbage out). "These seminars are stimulating adult education plus good fellowship!" *Ida B. Webster* reports that she has been appointed Secretary of the Citizens Housing and Planning Council of New York City and

that her firm has just completed drawings for the fourth New York City Housing Authority Project (Low Rent). Her new office is at 501 Madison Avenue. *Norman Weiss* says "after our 45th Reunion on Cape Cod we enjoyed a brief vacation in N.H. and Maine and have just returned from an eight week trip to S. Africa, Israel and Southern Europe. Mary and I look forward to Mexico City in the spring."

Deceased classmates

Milton E. Parker in writing to Forrest Lange comments on the passing of *Nelson M. Fuller*: "... sad news indeed to those of us in Course VII. . . . His homespun philosophy was always soothing whenever we might stumble over some blitz quiz. He taught us to laugh at such tragedies which he also shared with us. I shall always remember him as a sort of Will Rogers who never knew a man he didn't like. Good old 'Smoke'—the world will be just a bit grimmer for his passing." We have more to report on Professor *Sherwood F. Brown* who passed away last August 21. Born in Framingham, he graduated from high school there and after graduating with us he earned his Sc.D. from M.I.T. Professor of Physics at Lowell Technical Institute, he was a member of the A.S.E.E., American Association of Physics Teachers, American Association of University Professors, American Institute of Physics as well as Sigma Xi and Sigma Pi Sigma. We are indeed sorry to hear that Professor *Cyrus Lawrence Day* died July 5, 1968 in Bermuda. He was Professor Emeritus of English at the University of Delaware. Also we are sorry to hear of the death of *Alexander J. Tigges* on September 3, 1968.

Changes of address

Ernest L. Akerley, Apt. 510, 16000 Terrace Rd., E. Cleveland, Ohio, 44112; *William F. Barrett*, 16 Mansor St., Lowell, Mass., 01852; *George W. Bricker*, Box 544, Wilton, Conn., 06897; *William E. Dailey, Jr.*, Acton, Mass., 01720; *Edgar D. Deming*, 11 Sutton Rd., Needham, Mass., 02192; *Earle A. Griswold*, 47 Harbor View Dr., Portsmouth, N.H., 03801; *Hyman F. Marshall*, 10231 E. Bay Harbor Dr., Bay Harbor, Fla., 33154; *Harold C. Pearson*, San Carlos 86,

Mexico 20 D. F. Mexico; *Edwin H. Schmitz*, 405 Park Ave., Belleair, Clearwater, Fla., 33516; *Capt. Horatio C. Sexton*, Apt. 22, 670 Americana Dr., Annapolis, Md., 21403; *Joseph S. Sherer Jr.*, 618 Buhl Bldg., Detroit, Mich., 48226.—*Thomas E. Rounds*, Secretary, 25 Ridge Road, Danbury, Conn., 06810

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As most of you know by now, we have our second governor. *Blay Atherton* was the first. When Governor *Sherman Adams* went off to get Gen. Eisenhower elected president and then became his right hand in Washington, *Blay*, then president of the New Hampshire Senate, took over as governor. Had he run for reelection he would probably have made it, but *Kay* threatened dire things if he did. Those few months were all she could take of being a governor's lady.

Elected governor

But now we do have an elected governor, *Luis Ferré* of Puerto Rico which, if *Luis* has his way, will become our 51st state. He had run three times before as leader of the Statehood Republican Party, but this year he formed a new statehood group, the New Progressive Party. After 28 years' rule by the Popular Democratic Party, his campaign exhortation was "This has got to change!" And change it did. The *Miami Herald* seemed to think *Luis* would have a bit of trouble filling top jobs in his administration, because the Popular Party had become so firmly entrenched in government. It said he would have to induce business men to come in with him, and possibly even appoint some opposition party members. This sort of thing has previously been unknown on the island. But don't be surprised if brother-in-law *J. Adalberto Roig* turns up as Director of Fisheries. And *Clint Conway* suggests that *Paul Cardinal* might enlist some of his International Executive Service Corps men for duty with the new regime: *Howard Whitaker*, Director of Pulp and Paper; *B. Alden Cushman*, Banking Commissioner; et al.

Travelers

Now for the more leisurely pursuits that most of us have taken up. The *Max*

Ilfelds have been wintering in Mexico in recent years, but evidently it was time for a change with them, too. This winter they are taking off on a round-the-world cruise aboard the American President Lines ship, the President Roosevelt. Highlight of the trip will be an 11-day photographic safari in eastern and southern Africa. Maybe we'll see some galloping gnus and bouncing springboks at Bald Peak. Last summer *Max* and *Bertha* got back to this part of the country, at least as near as Lake Champlain. They visited *Clarke* and *Maggie Williams* who spend part of their summers on North Hero Island, Vt. on what *Max* describes as "the old Button estate, a real beauty spot equipped with all the amenities." This is an area also noted for its old fossils (Lower Ordovician).

The *P. H. Littlefields* have been having their troubles with the weather lately. Seems as though they can't go anywhere without blowing up a storm. Last spring when they were in Long Beach, Calif., they went through an earthquake and a cloudburst. In the fall on their way down to Naples, Fla., they met hurricane Gladys just north of Tampa, and found sanctuary in a Howard Johnson's just in the nick of time. A month later they landed back home in Norwalk, Conn., on Veteran's Day and just barely got into the house and slammed the door when that well-remembered Northeastern hit—snow and lots and lots of wind. We're certainly looking forward to seeing *Peg* and *Pret* next June, but the Reunion Committee is looking into Foul Weather Insurance, just in case.

Another of our inveterate travelers is *Rutilio Torres-Saravia* of Guadalajara, Mexico. You may remember that we wondered editorially last month whether or not he had taken his projected South American trip last year. The same day those notes went to the *Review* came a letter from *Ru* with the answer. He was to have left Mexico early in December for a combined business and pleasure trip to South Africa. After cleaning up that part of the world, presumably (he's a Sanitary Engineer), *Ru* was due to spend Christmas and New Year's Day in the Argentine followed by a tour up the west coast of South America, visiting old friends

along the way, and so eventually back home. "In each one of the cities I will try to get in contact with the M.I.T. Club. So you see, an effort is being made to revive the old Tech spirit of good companionship." Ru says he and Johnny Fitch plan to meet at the Fiesta in March, but at that moment he was not sure about the reunion.

A note to Paul Cardinal from Mike Amezaga says that he's retiring from St. Regis on June 30, 1969, "... by that time it might be RCA!" Ah, diversification. One other thing is definite, they will leave Chicago and move to Connecticut to be near daughter Horteia in Cheshire. All this will not interfere with their joining us in June at Bald Peak.

A card from Bermuda in November was evidence that the R. W. Ambachs have followed the example of the birds. Chicken? Just one, good, cold day and off they went to the south. "Would be in favor of this location for reunion at this time of year, but June would be out." Our reunion chairman did not expand on the subject further, but it's obvious he's looking ahead. And incidentally, one of the "younger" classes really is holding its get-together there this year. One of our classmates who could probably be depended on to attend such an affair, is Percy D. Fuller whose address is: "Surprise," Bertram Yacht Basin, Miami, Fla.

Quickies

John H. Skinkle: "Still traveling—Jamaica and Mexico last winter, Santa Fe for Christmas this winter, the Mediterranean this spring, Portugal, Spain, Italy, Greece, Istanbul." **Mitchell V. Allen:** "My daughter Betty, U. of North Carolina '65, and Philip S. Kilpatrick II, M.I.T. '64, were married on August 10. Dr. and Mrs. Stark Draper were here (St. Louis), for the wedding. My oldest son, Robert H. Allen, M.D., has one son named after me. My other son, George S. Allen, M.D., is still playing the field. My grandfather, my father, and I were all married at age 33, so maybe George is going to carry on the family tradition." You can well imagine circumstances when that would be a rough tradition to live up to! **Christopher M. Conway:** "Retired from A.T.&T. on October 1 last. Now located in Pineville,

La., my wife's home town. Climate permits being outside all year round. (You know Chris, even in New England some of us manage to get out during the winter.) Good golf course, excellent hunting and fishing, and gardens flourish. The people are friendly and the pace is leisurely. All in all, a fine retirement location."

Ernest L. Kallander: "Retired in 1966 and started to build a nine-hole, par-three golf course, doing most of the work myself. Expect to open in 1970." (Watch this column for the Grand Opening announcement of the Kallander Kountry Klub.) **Miles Cary:** "Now retired and enjoying it." (This was received in October along with a big stamp, "Return to Reason Vote Republican." Mike now has his return.) **Percy H. Wilson:** "Nothing of note this year. Just enjoying a relaxed life on the Monterey Peninsula." (Wonder if Percy knows that the explorer Viscaino named that peninsula in 1602 after

Senor Monterey, the viceroy of Mexico who sent him off on the voyage, and that his Carmel friars left the name of their order on a river? The things you learn in these pages!) **William W. Sturdy:** "I expect to retire from Bell Telephone Labs on May 31, 1969, and plan to move sometime in 1969 to a new home in Truro, Cape Cod."

Classmates deceased

Unfortunately three more have left our ranks. **Emerson J. Van Patten**, who had retired to San Diego, died last June. In that same month **Albert F. France**, one of our Navy men who retired in 1946 as a Rear Admiral, died in Annapolis. And **Philip A. Herrick**, for many years a California resident and active there in alumni affairs, died in Santa Fe last October.

Very shortly, or possibly before you read these lines, you will receive a listing of those who expect to foregather in the New Hampshire hills before long. The list grows longer daily. Hope you are on it.—**Henry B. Kane**, Secretary, Box 177, Lincoln Center, Mass. 01773

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By way of introduction, may I thank all of you who have been so thoughtful in sending along bits of news with your contribution to the Alumni Fund. It does permit your Secretary to let classmates know of the activities of many other members of the Class. To those of you who have made use of this method of communicating, please continue; it is hoped many more of you will do the same.

"Tink" retires

The *Dow Diamond*, a publication of the Dow Chemical Company, had some nice words to say about **Calvin Campbell**, who recently retired from that company after having served them for 33 years. At the time of his retirement, he was a member of the company's Board of Directors, general counsel, vice president, secretary and head of the Legal Department. He was also a member of the Executive Committee and the Finance Committee. The President of the company had the following to say regarding "Tink": "He has played a very important though seldom recognized role in guiding the company through its expansion. . . . We will miss his active participation in the Company but we wish him well in his retirement." Following graduation from M.I.T., he obtained an LL.B. from Harvard Law School. He also holds an honorary doctor of laws degree from Ferris State College. He joined Dow's Legal Department in 1935, became general counsel in 1940, was elected to the company Board of Directors in 1948, became secretary in 1949, and vice president in 1950.

In brief

From **Bernie Freudenthal** comes word that the company he founded in 1947, Chemical Service of Baltimore, Inc., and Lab. Automated Chemicals Corporation, manufacturers of chemical specialties, was sold in July 1967 to Imoco-Gateway Corporation of Chicago. Bernie is now President of the Chemical Divisions of the Corporation and Assistant Vice President. He plans to retire in mid 1969. . . . **Roger Ward** writes that he has moved back to Merritt Island in Florida, the site of the several moon

shots. He apparently cannot resist the attraction of pending excitement in that area. . . . *Ben Groenewold*, as many of us know, has retired to Sarasota, Fla., and his latest note indicates that he loves it! He indicates that he does some work for Howard Flather, '23, and sees a lot of Ray Holden, also '23. At the time of his writing, he was planning a cruise to the South Pacific and hopes to spend an evening with Colin Reith, '26, in San Francisco.

Captain *Julien J. Edgerly*, who retired in 1962 after 20 years' service in the Navy, followed this with five years' service as a supervisory Electronic Engineer in the Naval Civil Service, from which he retired to take up private practice as a Consulting Engineer. He indicates that he is now retired permanently to Charleston, S.C. He does find the climate there too enervating and he expects to move farther north in the spring. His son, Arthur, is Personnel Manager for Stop and Shop, has one baby daughter. They live in Bridgewater, Mass.—fairly close.

Paul Goble is now living in Chatham, Mass. which your Secretary now considers his home town, and it is hoped the two can get together. . . . *Melvin Shikes* who retired in January 1968 to the Phoenix, Arizona area has carried out his promise and is now affiliated with the Hammond Organ Company in that area, and is now putting a hobby to work and fun. . . . Mrs. *Lynwood A. Tripp* is engaged in a number of activities, having become a member of the Society of Women Engineers. She also belongs to the M.I.T. Alumnae, the M.I.T. Club of Northern New Jersey, and the M.I.T. Alumni Center of New York. She became a great-grandmother in October of 1967 at the age of 61!

Archer Nickerson reports nothing new except his success in attaining 65 years. He is only semi-retired, is back to doing basic design and becoming acquainted with computer solutions for secondary stress. . . . Professor *Y. H. Ku* was invited by the USSR 4th All-Union Conference on Automatic Control to present a paper entitled: "Nonlinear Control System Analysis." This Conference was held September 30 to October 5, 1968 at Tbilisi, Georgian SSR. . . . *Wade*

Johnson reports that he is spending his winters on Sanibel Island, Fla.; summers at Oberlin Beach, Huron, Ohio; and in between his travels is at home in Cuyahoga Falls, Ohio. . . . *David J. Hillis* simply reports that he recently retired.

Some months ago, it was reported that "Willard Allphin was active in the Volunteers for International Technical Assistance (VITA)." He has now written me to point out that VITA parcels out technical problems from people in developing countries to people in this country. He spent last winter touring Mexico and Guatemala in a pick-up camper. His freedom to traipse off like this is the result of his retirement from Sylvania Lighting Products in September, 1967.

A note in the *Bulletin of the American Meteorological Society* indicates that *Christos Harmantas* received a thirty-year length of service award recently from the Environmental Science Services Administration. . . . *Frank Warburton* was co-author of a rather extensive article in the *IEEE Transactions on Power Apparatus and Systems* last spring. The title of the article was "Corona and RI Caused by Particles On or Near EHV Conductors: II—Foul Weather." . . . Your secretary is indebted to *Garvin "Chink" Drew* for an article which appeared several months ago in *Financial World*. It was headlined "Growth at Genesco" and it gives an interesting rundown of the Jarman Shoe Company which later became Genesco, Inc., chaired by our classmate *Maxey Jarman*.

A visitor

Just as these notes were being prepared, *Masaru "Kamy" Kametani* dropped in on me. Although he retired some months ago, he is still very active and was on a business trip which brought him from Tokyo to the West Coast, Minneapolis, New York, Copenhagen, Denmark and back to Boston. Kamy is one of our most loyal alumni and always takes time to visit M.I.T., dropping in on the Alumni Fund Office whenever he is within a few miles of Cambridge.—*F. L. Foster*, Secretary, Room 4-144, M.I.T., Cambridge, Mass. 02139

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We have Christmas cards to address as well as notes to write so let's dig into the folder. We come to a recent letter from *John Fletcher*. "Dear George, Naples, Fla., is really a nice place and Port Royal is its best community. My wife and I have spent about a month in Naples each winter for many years and finally bought a place there last February. We will not reside there until the winter of 1969-1970. I plan to retire from the U.S. Tariff Commission about November 1, 1969. We have become avid shell collectors and the Naples area is a gold mine for shells. Shelling also gets you out in the fresh air, provides mild exercise and is a good way to get a tan. After I retire we may make it to New England in June for a reunion at M.I.T. or Exeter. It has been a long time since I have seen either place. Best, John G. Fletcher." John, if your ears burned last week, "Pink" *Salmon* and I had lunch at Pete's restaurant in Boston and several classmates were mentioned. In your P.S. you asked to be remembered to Bob Simpson, president of the Rockport Bank. I regret to advise that your friend, Bob, died last winter.

In looking over the list of awards to alumni whose efforts on behalf of M.I.T. in the 1968 Alumni Fund were outstanding, we see that *Herbert T. Creedon* of the New Canaan region was listed. Congratulations, Herb.

Do you recall that *Al Warner* of Santa Fe, New Mexico was showing a tear gas pistol upon which he had obtained a patent? He finally got going and writes, "This tear gas weapon is being produced under the name of G-G31. We have finally got production fairly well rolling and sales are beginning to pile up. For your edification, I am enclosing a circular that described the tear gas weapon completely. God willing, I will be able to make 1969 Homecoming and, once again, see some of the fellows that I had such a good time with in 1966. Sincerely, Al Warner."

A back-of-the-envelope message from Ben Richardson. "Hi George, We are pleasantly settled in our Vermont home



H. P. Ferguson, '27 J. T. Chirurg, '27

for the summer. For a hobby, Evelyn and I are deep in genealogy. Much to our surprise we found we were related in the tenth generation. When we return to Conn., will have those pictures of "A Night to Remember" duplicated for your slide projector. *Ben Richardson.* Ben, we are looking forward to receiving the slides you mention. Another note from *Ed Hope* comments, "Dear George, My wife and I still remember with pleasure our 40th and especially your home. Give us a call sometime when you are in this city. Best wishes, Ed."

The local color of Pigeon Cove

Somehow we are having trouble getting cranked up this early December morning. It's overcast outside and the sea is covered with whitecaps indicating heavy wind from the northeast—a "dry nor' easter" in local terminology. This local terminology becomes most interesting when applied to some of the local people. If you are a native of any consequence you will likely have a nickname. The chairman of the board of selectmen has always been known as "Squizzle." I knew his grandfather only by his nickname which was "Hawker" evidently acquired when he was a fish pedlar. Another local character is known as "Gun Boat," presumably because of his enormous feet. A local lobsterman is called "Straw Hat" Nelson. The fellow who always carries the flag in the Fourth of July parade is known as "Eagle Ogle." There probably are reasons behind all the names, such as an old timer who was known as "Dark Bedroom" Poole who apparently had no way of knowing when he woke up that it was daylight outside.

The professor retires

In a recent M.I.T. publication we learned that *Herb Beckwith* has retired from teaching. "Professor Beckwith, a member of the architecture faculty since 1926 and acting head of the department in 1956-57, is a world renowned architect. As senior partner in the firm of Anderson, Beckwith and Haible, he has been co-designer of several M.I.T. buildings including the Alumni Pool, the Dorrance Building, the Whitaker Building, Rockwell Cage and McCormick Hall. He also was associated with Eero Saarinen in the development of Kresge Auditorium and

the Chapel. Professor Beckwith has designed numerous other university, corporate and public buildings throughout the U.S. and in Japan, the Philippines, Burma and Formosa. A prominent Fellow and member of the American Institute of Architects, he has served as vice chairman of that organization's Committee on Education and as a member of its National Committee on the Profession." Herb continues to live in Kingston, Mass. and we presume will remain active in his architectural firm.

With that pile of Christmas cards wanting to be addressed we must sign off. The sun is trying to break through and Heather has barked a couple of times to remind me that I promised to take her walking. So until March—Cheerio.—*George W. Smith*, Pigeon Cove, Mass. 01966

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This is an anniversary issue of the 1927 notes, of sorts. A search of the files unearthed the fact that I first took pen in hand to write the notes for the February, 1944 issue of the *Review*. And here it is, just 25 years later. Here are some of the things that were reported then: Colonel S. S. *Auchincloss* was in charge of all planning for the Signal section of General MacArthur's staff; Colonel *Albert Burton*, who had a big hand in the design of American landing barges, was district engineer of the Philadelphia office of the U.S. Army Engineers; *Russ Westerhoff* was an assistant project manager for Ford, Bacon and Davis; *Jim Lyles* was made a director of the Bronxville (N.Y.) Trust Co.; *Charlie Hurkamp* was at Curtiss-Wright in St. Louis; *Frank Mesker* was turning out "military devices" at Mesker Bros. Iron Company in St. Louis; *Edward O. F. Jones* had just joined Cook Electric at Greenwich, Conn.; *Lee McCanne* addressed the Sales Executive Club of New York; and, finally, *Ezra Stevens* and *Dike Arnold* had just incorporated the Stevens-Arnold Company in Boston.

Jim Lyles, improving all the time and living in his family's 18th century home in Canaan, Ct., writes that he is "inter-

ested in everything, including antiques, early American tools, historical societies, M.I.T. reunions and friends, six fine grandchildren and a power lawn mower." More power to Jim.

James E. Forbes retired from M.I.T.'s Division of Sponsored Research staff in July, 1968. . . . Returning from six months in Italy, Spain and Portugal, *Francis Burke* reports "prosperity relatively high everywhere, with a great number of high-rise low-income apartments under construction. Encountered no anti-American feeling anywhere. Everyone was friendly."

Speaking of travelers, the *Ed Damons* are off again, this time to South America. . . . *Howard Ferguson*, who was manager of wholesale and subsidiary sales for Standard Oil Co. (Ohio), retired last August and is "currently moving from our long-time home to an apartment to make traveling easier." . . . *Pub Whittier* is now Packaging Consultant, Glass Container Division of Owens-Illinois, Inc. . . . *Walter G. Walker Sr.*, retired from the NASA Langley Aeronautical Laboratory at Hampton, Va., in 1966 after 40 years as an aeronautical and space technologist. Now he is active in the work of the National Association of Retired Civil Employees, travels and is an amateur radio operator. (Has had call W4AKN for 50 years!)

A nice newsy Christmas card from the *Lester Woolfendens* explains that Les is now running the Linden, N.J., plant of the General Aniline and Film Corporation. This is far cry from Paducah, Ky., where Les has been so long with GAF. In October, Les plans to retire and he and Ethel will return to Paducah.

Receives Wetherill Medal

A further—and fourth—honor has come to *Nat Cohn*. He has received the Lamme, Sperry and Engineer-of-the-Year awards (see previous issues) and now the John Price Wetherill Medal of the Franklin Institute of Philadelphia. The citation is for "automatic control of generation and power flow on inter-connected electric power systems." . . . *Jim Chirurg*, former chairman of Chirurg & Cairns, Inc., advertising agency, has been elected to the Order of Achievement of

Lambda Chi Alpha fraternity. The honor indicates distinction in the fields of business, art or science. Since his retirement as chairman of the agency last September, Jim continues to serve as director.

Conrad award

William A. Zisman, Chief Scientist of the laboratory for chemical physics at the Naval Research Laboratory, Washington, D.C., has received the Navy's 1968 Captain Robert Dexter Conrad award for "his notable research in chemistry during the past 29 years." The award was made by Secretary of the Navy Paul R. Ignatius. Dr. Zisman's research in surface chemistry and physics has led to numerous applications in such areas as corrosion prevention, wetting, adhesion, friction and wear.

Changes of address

Joseph L. Burke, 4 Valley Rd., Danvers; *Richard Cutts Jr.*, Apt. 206, 44 South E. 14th St., Boca Raton, Fla.; *George B. Darling*, Atomic Bomb Casualty Commission, U.S. Marine Corps Air Station, FPO Seattle, Wash.; *Howard P. Ferguson*, 939 Aintree Park Dr., Cleveland, Ohio; *John L. Locke*, Apt. 6, 222 School St., Walpole; *Philip W. Rugg*, 699 Middle St., Portsmouth, N.H.; *Wayne B. Wagar*, 829 Ashland Dr., Mount Pleasant, Mich.; *Lawrence B. Whit*, Eleven O'clock Rd., Weston, Conn.; *Miss Hilda Young*, Toll Gate Square #A-2, Worthington, Ohio.—*Joseph S. Harris*, Secretary, Box 654, Masons Island, Mystic, Conn. 06355

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Continuing with our backlog of mail received during the summer months, we have a seven-page letter from *Howard Pankratz* of Riverside, Calif., in which he recounts some of his fond memories of early days at M.I.T. and his adventures following graduation. In 1963 Howard abandoned his engineering practice in Cleveland, Ohio, and moved west to Riverside. After a short try at retirement, he took up a position with Certain-Teed Products Corporation as a mechanical draftsman; he found much satisfaction in helping them build a new asbestos cement pipe plant. He and his wife, Margaret, celebrated their 40th wedding anniversary in December 1967 and have a daughter Nancy who is married to Dr. Peter L. Ames, University of California, a zoologist and ornithologist. Granddaughter Elizabeth "Muffin" Ames, age four, obviously brings much joy to the Pankratz household. Howard's side hobby is "fooling around" with a Mercedes and a Bavarian Motor Works, 2000 Touring International, which won the European Road Races for four-door sedans in 1967. Howard says he plans to attend the 40th reunion. We'll be looking forward to seeing you, Howard, and thanks for the interesting letter.

Green thumb

Frank Pierson writes from Cromwell, Conn., where he is now Treasurer and Comptroller of A. N. Pierson, Inc.,

Florists and Nurserymen. Very appropriately his letter was typed in green print. Until three years ago Frank reports he had worked as an efficiency and management expert and his letter summarizes some of his experiences in this line. He also was connected with the mechanical and chemical field for 15 years and finds this helpful in the florist business where he says: "We have two boiler houses with a total capacity of about 350,000 lbs/hr steam generation. We have 62 motor vehicles, vans trucks, tractors and cars to care for; 53 tenant houses housing about 80 employee families to maintain, plus the steam, water and electric lines, refrigeration equipment, etc., in the 35 acre greenhouse plant and the various sorting, packing and shipping areas in the home plant and seven wholesale houses located in Maine, Massachusetts, Rhode Island, Connecticut, New York and New Jersey." Although June is a busy month in this business, Frank is hoping to attend the 40th reunion "to resume old friendships that I've allowed to wane with the years." Nice to hear from you, Frank, see you in June.

Time out to write

John D. McCaskey of St. Joseph, Mo., sent a very concise resume in September entitled "Twelve months in the life of a retired, sixty-year-old '29er" from which we quote his activities. September 1967—Portugal, Spain, Mallorca and England. October 1967 to January 1968—Student, Missouri Western College, Class of 1971. Going for A.B., Psychology and History; B.S. Education. Substitute instructor, same college, U.S. History, French, Spanish. February and March 1968—fishing, swimming and travel in Mexico. sixty-six hundred miles by car. July to August 1968—summer school, Missouri Western. August to September, 1968—trout fishing in Jasper, Banff and Glacier National Parks. Also Black Hills 5200 miles by car. High point was visit with Bill and Maxine Aldrich in Billings. Sent back to college. Twelve months—swimming most days." And, above all, he took time out to write to the class secretary. Many thanks, John.

Reluctant commuter

Arthur Jones advises: "After 33 years working within six miles of my home, my department was moved to New York Headquarters in 1963, so I am now a reluctant commuter. Present position: Chief Engineer-Administrative (Engineering & Research Department), Anaconda Wire and Cable Company. Activities over past 25 years have been increasingly administrative, but I occasionally get a finger into technical problems of cable design and application. Have just completed 20 years service as Secretary on ASTM Committee B-1 and USASI Standards Committee C7, both on electrical conductors. Last year was privileged to attend the meetings in Rio de Janeiro of the Pan American Standards Commission (COPANT) Committee 4:2 on electrical conductors as the U.S.A. delegate representing the copper in-

dustry. Principal hobbies: driving, Hi-Fi, reading, and trying to find a little spare time!" Thanks for the letter, Arthur.

Ed Farmer sent us a Bell Laboratories report on their monolithic filters which are now being produced for coaxial communications systems. The development program for these smaller, less expensive crystalline quartz plate filters was directed by *Roger A. Sykes*.

Classmates deceased

We have notice of the death of *Sister Mary Edwina* of Dayton, Ohio, on November 22, 1967; also the death of *Selwyn Towne*, September 24, 1968. Selwyn made his home in Schenectady, N.Y., where he was a naval architect.

He was chief engineer for the Bath Iron Works in 1940 and later was appointed to General Electric's Knolls Atomic Power Laboratory where he worked on the USS Sea Wolfe, the second atomic submarine. Our sympathy is extended to their families.

Am sure you have received reminders about the 40th Reunion in Wianno June 13, 14, and 15. Hope you are planning to attend. Best regards.—*John P. Rich*, Secretary, P.O. Box 503, Nashua, N.H. 03060

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As regular readers of the class notes know, the names of certain classmates appear fairly frequently while the names of others do not appear at all. I hasten to say that this phenomenon is not due to any bias on the part of your secretary, but rather to the asymmetrical flow of information. I was therefore particularly pleased to receive a report this month from *Angelo Ricciardelli* who has not previously appeared in the notes during my secretaryship. Angelo retired from the Army as a colonel after 22 years of active duty. He is now working as a member of the Technical Staff of Communications & Systems Inc., Falls Church, Va., where his work involves systems planning of communications facilities including satellite communications facilities, mostly involved with Department of Defense systems.

The Ricciardellis have six children. Claire graduated from St. Mary's College in South Bend, Ind., and is doing public relations work in Washington. Michele is a senior at Univ. of Tennessee and Peter a sophomore at Univ. of Virginia.

David is a High School senior planning to attend Auburn Univ. next year and Laura and Edward are in elementary school. Angelo himself is working toward a masters degree in engineering administration. Understandably he reports that: "The high cost of education and number of dependents prevent me from going into permanent retirement." Notwithstanding his busy schedule, Angelo is planning to take time off to attend the 40th reunion.

I had a pleasant luncheon recently with *Lester Steffens*. As previously reported in the notes, Les is in the Mobil Oil planning department and is concerned with the planning of domestic operations. The Steffens' oldest daughter Elizabeth, after teaching in Japan for a while, is working toward a masters degree in asian studies at Washington University in St. Louis. Barbara has a masters degree in psychology and is working as a psychologist in a state hospital for retarded children in Michigan. Katherine will graduate from high school this year. Les has been an ardent sailor for a number of years and has reversed the usual trend in that he has moved progressively toward smaller boats. Currently he owns and races a Sunfish. He also sings in the chorus of The Troupers, a Fairfield County dramatic group that puts on Gilbert and Sullivan operettas.

Ted Riehl is Chief Chemist of Goodyear Tire & Rubber Company in Akron. The Riehl's older son, John, has a B.A. from Princeton, a Ph.D. from M.I.T., did post-doctoral work at University of Nottingham and is on the faculty at Penn State. Younger son Charles has a B.A. from Colgate, served in the Marine Corps in Vietnam and is now studying law at Case-Western Reserve. Ted reports having recently seen Jack Bennett, Herm Botzow, Ralph Rowzee and Phil Holt.

Classmates deceased

Reports have just come in on the deaths of two more of our classmates, *John Rogers* on August 4, 1968 and *David Q. Wells* on September 30, 1968. John had only recently retired to Florida from his job as superintendent of parts manufacture for the Kodak Apparatus Division of Eastman Kodak. Unfortunately I do not have any details. Dave lived in St. Louis and was a loyal and active M.I.T. alumnus. Those of you who attended the 30th reunion will recall that he and his wife Jean had a charming summer home at Wianno and that they generously invited all of those attending the reunion to a delightful cocktail party. Reference to the November 1960 notes reminds me that Dave had incorporated a number of unusual and imaginative features in the house including a set of tiny inlaid footprints leading through the house and terminating at the refrigerator door. Reaching further back some of you may recall Dave's prowess as a member of the gymnastic team. I have a rather vivid recollection of Dave doing giant swings on the horizontal bar. Because of his considerable height those swings were a spectacular performance. I do not have any current information about Dave's family but hope to be able to give further details in a later issue.

Changes of address

Joseph Guerrieri, 4390 Bridgeview, Oakland, Calif. 94602; *Henry M. Nelly Jr.*, 1255 E. Maryland #B, Phoenix, Arizona 85014; *Robert B. Rypinski*, 8248 Tuscany Ave., Playa del Rey, California 90291; *Charles M. Twelves Jr.*, Apt. 323, 125 New Court, Walnut Creek,

California 94596.—*Gordon K. Lister*, Secretary, 530 Fifth Avenue, New York, N.Y. 10036

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What a pleasant surprise it was recently to join a friend in Geneva, Switzerland, for brunch and find that *Cliff Harvey* and his wife were there also. Cliff is another radio ham (WIRF), he and Helen live in Sturbridge, Mass., and they have spent a number of their vacations visiting various countries in Europe. Thanks to *Howie Richardson*'s recent "goad," *Norman FitzGerald* has brought us up-to-date on his family. Norman writes: "The FitzGerald's are still living in Abilene, Texas, producing oil and wild-cattling for more. We spend the summers in Quincy, Mass., on the Bay. Eldest son, Scott, is stock market analyst. Second son, Dr. Carl, (also M.I.T.) is assistant professor of mathematics at University of California at San Diego. Youngest son, Texas, is managing editor of the high school newspaper. Brownie is active in a dozen organizations for the benefit of others and herself. Last month I went to London for the International Monetary Seminar then on to Switzerland to visit the bankers and some brief sight seeing. Now back to the business and profession of hunting for petroleum."

On the distaff side, Mrs. *Marjorie A. Heath* (Miss Marjorie A. Holden in our undergraduate days) writes: "Although it seems a little late to report (as Deputy Governor of the New Hampshire Society of Mayflower Descendants) I presented the Memorial Day wreath for the General Society of Mayflower Descendants at the Cathedral of the Pines in the absence of the Governor General and State Governor."

Word from *Herb Raymond* (Treasurer of the Tech Club of New York) says that cooperation between the Tech Club and the Alumni Center is coming along very nicely, using the dining service at the Chemists' Club. . . . *John Spalding* is Vice President and Director of Nekoosa-Port Edwards State Bank. . . . *Jim Byrne* is Director, Division of Engineering, U.S. Forest Service in Washington, D.C. . . . *Albert R. Sims* tells me that his last daughter is in her senior year at the University of Wyoming and adds "so, theoretically at least, next year, after many more years than I want to think about, I will be under less pressure financially. (Ed—Amen.) . . . *A. D. Vincent* has retired from E. I. Du Pont de Nemours after 38 years with the company.

News from *Elliot Whitaker* reports that he travelled during last summer to Hawaii and Japan and also that he was given the honor of a Fellowship in the American Institute of Architects in June 1968 at Portland, Oregon. . . . A note in the IEEE Spectrum announces John Dyer's appointment as President of Cutler-Hammer, Inc.'s Airborne Instruments Laboratory Division in Deer Park, N.Y.

John joined AIL in 1945. Speaking of *John Dyer*, I notice that the masthead in the *Magazine of Cambridge* indicates that he is Vice President of the Cambridge Chamber of Commerce. A Drew release announces that *Jim Fisk* was awarded Drew's first honorary Doctor of Science degree.

Ken Germeshausen was one of the leaders at a recent one-day conference given by Boston University, titled "Stimulating Innovation: An Examination of Management Attitude, Proprietary Policy, and Creativity." . . . A Tech publicity release tells that *Gordon Brown* is relinquishing his post as Dean of the School of Engineering to turn to other interests and activities. He has been appointed to a new chair, the Dugald C. Jackson Professorship in Engineering.

Word has just reached me that *Arthur Chapin Seelye* died at his home in Spencer, Mass., on March 25, 1968. Our deepest sympathy to his family.

By the time you read this, it will already be 1969. Hope you all have a happy New Year.—*Edwin S. Worden*, Secretary, 35 Minute Man Hill, Westport, Conn. 06880

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Received the following information from *Rolf Eliassen*: "Have recently completed my sabbatical year at Stanford University. Spent one quarter travelling to Japan, New Guinea, Australia and New Zealand, observing local environmental problems and their solutions (in some cases, like air pollution in Japan, the condition is near hopeless). Spent another two quarters in the Executive Office of the President on the staff of the Office of Science and Technology in Washington supervised the writing of a long report to President Johnson on Solid Waste Management, a field in which the Federal Government must play a larger role in curbing pollution. While in Washington, our older son, Tim, presented us with our first grandchild, a girl. He is a Lieutenant in the Navy, having served on the staff of Admiral Rickover for the three years since graduating from Princeton. This is a great experience for a young fellow interested in the nuclear reactor field. Our younger son, Jim, graduated in June as a geologist from the University of Redlands (California) and he is now a graduate student in water resources management at the University of Wisconsin. Please note our change of address: 1910 Newell Road, Palo Alto, Calif. 94303."

Rudolph Tietig, Jr., writes: "Have just returned from a seven-weeks' trip to Europe with my wife Iva. Trip included two weeks in Moscow where I presented a paper at a world steel symposium sponsored by the United Nations. Have been with Kaiser Engineers in Oakland, Calif., for the past twelve years specializing in steel industry work. Address is 1017 Via Roble, Lafayette, Calif. 94549."

James M. Shackelford retired from Johns-Manville in the spring of 1968, and is now employed as Administrative Assistant in North Carolina State Government and is enjoying living in Raleigh.

F. Rolf Morral sends along an account of his family: "Oldest son, Frank R., is Assistant Professor of English Literature at Carleton College, Northfield, Minn., and son John E. completed his Ph.D. in Metallurgy at M.I.T. in September 1968. My wife Lillie and I are enjoying our four grandchildren. Daughter Sandra M. got her M.D. at Rochester University in June and Ann I. finished her M.A. in clinical psychology at OSU in September and both are now interning. Never a dull moment."

An announcement of the executive officers of the firm of John P. Chase, Inc., Boston, includes the name of **Oliver H. Scharnberg** as President.

Isaac H. Schwartz writes that: "I got a good scare from a coronary attack in April of 1967 and am now 'running for my life'—two and a half miles every morning before breakfast. Back in good enough shape to carry on as Chief of Pediatrics, Chief of Electroencephalography, and full time private practice, etc."

An obituary in the Boston papers November 15, 1968, gives us the only information we have of the death of **Nathaniel Saltonstall** survived by his sister, Mrs. Philip B. Weld, of South Hamilton, Mass., **Elwood W. Schafer**, Secretary, Room 13-2145, M.I.T. Cambridge, Mass. 02139; **James E. Harper**, Assistant Secretary, 2700 South Grant Street, Arlington, Va. 22202

33

Another month rolls around and not too much mail from the faithful (?), but, the Alumni Fund capsules, the clip bureau, and the Register all help out to make us look, perhaps, better than we deserve. This month is usually a lean one news wise, and I have been saving an item concerning the 35th. This seems to be the time to bring it up. Thirty odd men attended the 35th, but, avoided the camera. When the 40th rolls around, I want to have snaps of 100 per cent of the attendees, so I need a snap of the following, with a short personal sketch for the notes. The snap is in the mandatory class, and the sketch is almost that! The names, **Werner Bachli**, **Charlie Bell**, **George Bentley**, **Maurice Brashears**, **Charlie Britton**, **Laurence Brown**, **Joe Carbonell**, **Carlie Cashman**, **Robert Crane**, **Guido Garbarino**, **Ivan Getting**, **Frank Gilmore**, **Cyrus Hapgood**, **George Henning**, **Richard Hodgdon**, **Gerard Kincaide**, **Lennox Lindsay**, **John Longley**, **Courtenay Marshall**, **Dave Nason**, **Alexander Nichiporuk**, **James Norcross**, **Otto Putnam**, **Steve Rhodes**, **Robert Richardson**, **Robert Ripin**, **Fred Roetting**, **John Rumsey**, **Raymond Smith**, **Olavi Viita**, **LeBurton Webster**, **James Welch**.

Now, fellas, I was not the only one taking pictures, so, if anyone who reads this, has a snap of any of these, please send it to me, pronto. And, anyone named above; I beg and implore you to find a snap or have one taken, and send it to me. Heck, men, this is for the record, and ought to be a complete record, no? The only thing I can do, further than this appeal, is to write to you personally, and, Egad!, that takes too much time. So please save me the 6¢ postage, and, the tedious job of writing to you, individually, which, men, I will, never fear. Folks, this appeal also appeared in the Interim Letter, and, not one came through. You cannot all be that busy, and that I know.

From Aerospace, Los Angeles, (**Ivan Getting**, President) comes a short one, a clip, saying that **Gilbert W. King**, Vice President, is now just that in charge of General Operations, with the additional title of Operations General Manager. The good Doctor has taken little time to get close to the top, as it seems only yesterday that he left New England. Your classmates congratulate you, Gil.

Also, recently in the news is our old Course II playmate, **William A. Kilbourn**, complete with rear view photo, in a short *Mitre Matters* article. Bill was snapped during a platform talk with a comely maid designated as "Miss Mitre." Bill, this is all very fine, but, incomplete, and we need further info in order to make all this into something that can be used as evidence, later. Your rear view is definitely not comely, though the side view of Miss Mitre is quite so. Lets have it all, Bill, and what was the occasion, for heaven sake? (See p. 142, December Review—Ed.)

Although some of the following has been mentioned before, in all fairness, we now come up a more complete and satisfactory story of our own **Gene (Eugene) Sullivan**, who recently left O'Connor for greener fields Gene has joined the J. Slotnik Company, as Executive Vice President, to work as coordinator of the firm's Beth Israel Hospital project. It is still news even though Gene joined Slotnik in 1966 without telling us. The new job is a promotion. He was with O'Connor for a quarter of a century; with Frankini Construction Company of Medford, 1940-41; and from graduation until 1940, was estimator, general contractor, and field superintendent for the Edmund J. Rappoli Company of Cambridge. Gene is a Registered Professional Engineer; a member of the Massachusetts and National Professional Engineers Society, and is a Director of the Woburn Boys Club. That last, men, is something indeed, in this man's opinion.

During World War II, Gene was Hull Superintendent for the Navy's Bureau of Ships. He has helped design and build dozens of buildings, such as the present administration building at West Point, the Raytheon Building, and Beth Israel Hospital. The Sullivans have seven children. They also have 32 first

cousins in Haverhill, Mass. This, we submit, is not an accomplishment; merely a happenstance, like becoming a grandfather. Gene married Lillian Legasse of Haverhill, and, just as an aside, **Tom Galvin**, one of our own, married Lillian's sister. Well, Gene, it could not have happened to a nicer fellow, and your classmates join me in expressing our congratulations. Now that Lillian is rapidly regaining her health, why not drop us a line thanking us for such a fine piece of publicity. Haw! Great stuff, Gene, and keep it up.

We have one short item on **Philip C. Rutledge**, one of our better educated classmates, who remained for his masters after we had gone to work. Phil is now, and has been for years, with Meuser, Rutledge, Wentworth and Johnston, of Madison Avenue, N.Y.C., Professional and Consulting Engineers. Phil, it seems, was part of the program of a very special conference held at the Institute, in August, and on a rather special subject: Improvement of Soil for Structure Support. We have no details on how soil will be improved, but, if it can be done, Phil is the man to handle it.

We are in a bit of a quandary concerning our **Joseph J. Dysart**, whose press clipping makes him a graduate of Ohio Wesleyan, A.B., and then an A.B. in aeronautical at M.I.T. After this he took one year as a Sloan Fellow, all of which seems to make him a '33er. Anyway, Joe was made, in October, a Vice President of Douglas Aircraft Company, a subsidiary of McDonnell-Douglas Corporation. Joe will be in charge of product support and program management for Douglas in the DC-8 and DC-9 programs. He has been with Douglas for 18 years, and prior to this he spent 15 years with Pan American Airways as Chief Project Engineer for new aircraft development. After that he was manager of Maintenance and Engineering at Brownsville, Texas, New York City and Miami, Fla. Joe, his three children and his lovely wife, Veronica, live in Van Nuys, Calif. Last now, but far, far from least comes word of he who is probably our most eminent classmate, **Morris Cohen**. What a thrill it was, to me, and probably many others, to have Morris show up at the 35th; the big, handsome metallurgist, Professor of Material Science and Engineering at M.I.T., Morris was honored by the American Society for Metals at the ASM annual reception and dinner in Detroit, October 16, during the ASM Materials and Engineering Exposition. The honor was the Gold Medal Award of the Society, and at the same time, Morris was made an Honorary Member. The question always arises, in connection with class notes and news; how much does one dare to repeat about this remarkable man, or others like him. However, we cannot ignore mention of his various honors; he has received 14 major awards from ASM, including medals & lectureships. He has the distinction of being one of three men who have received the Howe Award Medal twice. Five ASM Chapters have honored

him with their highest awards. Morris has been a member of the Boston Chapter for

27 years, and was its Chairman in 1954. We cannot possibly enumerate all the societies to which Morris belongs; the committees on which he has served; the Boards on which he has served. But we must mention that he delivered the opening lecture at the First International Conference on Strength of Metals and Alloys in Tokyo, September 1967, and he has recently been elected to the National Academy of Science. Morris has published over 150 articles on the various phases of his remarkable profession. Morris, if I were addressing a large group of your peers and associates, I would ask that they all stand for a real ovation, standing and cheering. You might, of course, drop me a line, occasionally.

Now comes a new; one who is seldom heard from, and this time via the press, *Charles P. Woods*. Charles P. is with the National Underwriter Company of Cincinnati, Vice President, and recently, Sales Director, a job he took over in 1950. Another replaces him, but, old Chuck stays as Vice President and will handle corporate and special assignments. Chuck was with Dun and Bradstreet before 1950. This special tid-bit is too short to allow for much comment, but maybe Charles will come through with his family background now that he finds that he is one of us. Best of all there is, Chuck, and drop a line.

Womanpower

Bill, L. W. Moore, President of American Oil Company, again makes the news as he was the principal speaker at the annual meeting of the Desk and Derrick Clubs of America, in Chicago. Bill's subject was "Womanpower." "Meeting the challenge presented by a dynamic, expanding economy in the 70's and beyond will require American business to employ all the financial, material, and human resources available if we are to maintain or present high standard of living. We will be faced with problems in world trade in meeting demands for our goods abroad, and we must solve one of our most pressing problems, poverty in the ghettos. Business is and will be, challenged, seriously." Without further excess quoting, Bill goes on to stress that it is not enough to talk of man power, but we must make use of our "Womanpower," as well, a resource with which we have not coped adequately, especially, in middle management. Bill has talked on this at length in the past. Employment needs of the near future will cover the whole range of job levels, which will mean providing more and more basic training for men and women; the solution of motivational problems in racial situations; or, in many cases, a combination of both. A whole lot of imagination is involved in attacking the problem of training and employing young men and women with no skills for jobs involving at least some skills. And, we must use the same imagination in attempting to employ young mothers with

children, who wish to and must work, to help support the family. Classmates, *L. W. (Bill) Moore* is one of our better informed and capable peers. Bill always says a mouthful, at times when his speeches are most aptly indicated and needed. Good stuff, Bill. I wish you answered your mail just half as well. We get a better than average number of comments on your Chicago speeches. *Emerson (Emmy) Norris* was for going right out to Chicago when he read the condensation of an earlier speech.

Visitors

The Alumni Seminar, usually held much earlier, was held this year from November 9 to 11, and, I think for the first time, wives were also in attendance. I have heard nothing from any who made it, except that *Russell Eddy* sent me the printed mimeo list of those who attended, which leads to an anecdote. Russ wrote me several days in advance that he would be passing through Exeter on his way to the Seminar, accompanied by his wife and I suggested that he stop and visit. So, on a given day I was making a few minor repairs in my tool shed, and *Stan Walters* hove into sight. I reminded him that he was not Russ Eddy, and he agreed. Stan is not a regular visitor, but he does make it once in a while, and we do get a chance to visit before he takes off for Cheshire County, N.H. It was a rather cool day, and the next was worse, and along up the drive came this fine looking man, who I thought must be *Russ Eddy*, but, he had a hat on, and Russ has, or had, curly hair. So, I saluted the man and asked him to take off his hat, which he did, and this chap had very little hair at all, if any. Won't you fellows be surprised to find that my visitor was *Emerson (Emmy) Norris*, formerly of Great Neck, L.I., and now of Newcastle, N.H. Neither of these callers could tell me very much new, unfortunately, but, I, and they, did enjoy a lot of good old fashioned gossip, mixed with our genuine reminiscences. Most remarkable was Old Stan making his trip wandering around the county with just a jacket for protection, and Emmy was bundled up into an overcoat and all. Emmy's story appeared earlier; he was just making it official, being a brand new neighbor. So, I enjoyed both men, for sure. Next day, Russ Eddy showed up with his good wife, and we had a short one or two to speed them on their way to Cambridge, and a night at the Somerset. Again, I say that I am the world's worst reporter, as I always forget what was said, but, I seem to do much better with something that is written. There is the tip, folks, write it down and get a mention. I do wish that more fellas like Stan, Emmy and Russ would stop in to see us at the farm or even in Florida. Leona and I enjoy it all immensely.

From the mail pouch

Occasionally my day is brightened by a note from and old Course II; this time *Roger Putney*, another of our better educated classmates. Roger, God Bless

him, tells me nothing about his work, his family, his troubles, or anything, except, his hobby, photography. And, this time Rog comes through with a pair of prizes for his photos; one of two white ducks against a very dark background, and, a similar study of an old schooner in Wiscasset, Maine. For these two, Rog took one blue ribbon, and a silver bowl at the Scituate (11th) Art Festival, this year. The honor pleased Rog no end, and he wrote at some length about it. The Putneys, it appears, have moved back to Rockland, Mass., where "our hearts were", into a house that they built long ago, before they moved to South Weymouth. What a fine thing to do, and what a real human interest story that is. Rog, you and the little girl are my kind of people. Only incidentally, folks, Rog to us is Larry to those on the southeast coast of Massachusetts. Thanks a million, Larry Roger. Next time tell me something of a more biographical nature, or I will have to write you myself.

From Vice President *Fred Murphy* we got a short one telling us that the 35th reunion souvenir glasses, with the M.I.T. emblem on them, are finally shipped. Yeh, Fred, we received them, and took them to Florida, as the others are to remain in N.H. Many thanks, Fred, for being so patient, as indeed we were ourselves, no? So, upon request, we did help Fred to locate *Mal Fleming*, which was easy enough. Fred, thanks for the letter, as you must know that sometimes a little goes a long way.

Another Vice President heard from was *Ellis C. Littman*, our St. Louis Foreign Office man. Ellis sent me a press release about a classmate from the Caterpillar Tractor paper, and a short note. So, Ellis will be pleased to know that I have mislaid the press release, and have saved his note. Well, it is of a personal nature anyway, so many thanks Ellis, and perhaps you remember what the release said. From Green Turtle Cay, Bahamas, comes a flyer from *Walt Skees* (advertisement), and, a Christmas card, which, I expect, means 1968, though I got it early in October. Walt acknowledges his receipt of the "Interim" letter in such a way as to suggest that it is the only time, yearly, that he hears from me. I must send Walt a card suggesting that, for \$20-\$25 he can read me 9 times a year, and no fooling, some say it's worth it.

From *Mal Mayer* comes a plaintive note!! He can't seem to locate either *Wolfgang Kloenne*, or *Lambert Snow*, in South Africa. Mal, when you read this you will discover that Kloenne lived at the address which I gave you only a few months, and a subsequent letter from him gives another address. The shortage of phones is a common complaint in South Africa. Better luck next time. Those chaps move so often as to suggest a savings in rent. Mal is having a better trip this time with more leisure for his sightseeing, and will travel north and wind up at the Great Victoria Falls.

Instead of describing South Africa, Mal suggests to me that I read, *A Very Strange Society*, by Alan Drury. Now, how does one like that? The man is a real character. Thanks a whole lot, Mal, and best to your lovely girl, too. Now, a fitting sequel to Mal's story is that of Wolfgang Kloenne, mentioned above, who is from South Africa. Wolfie enjoyed the Interim letter, as well as *Jim Turner's* bit as our new Class President. He also says that he is about to ask his bank to send in his usual contribution to the Alumni Fund, credit for which goes to our 40th Reunion Fund. Kloenne now announces that he has moved back to Johannesburg from Cape Town, and has accepted an interesting job as an Industrial Management Consultant to one of South Africa's big steel works. The company, Dunswart Iron and Steel Works, Limited, has just taken over another foundry for casting iron, steel, and brass. On a graver note, Wolfie says that they lost their eldest son in a motor accident some time back. We had not heard, friend, but we are with you in your sorrow. Thanks a great deal for your thoughtfulness in writing us, Wolf, and do not hesitate to ask if we can do anything for you.

Now for a few Alumni Fund Capsule stories. From *Richard Faldetta* we learn that his oldest daughter graduated from Saint Mary of the Springs College, Columbus, Ohio, and is now teaching in Providence, R. I. Further, Dick shared a motorcycle with his son, Steven, last summer, and finds that it is a great sport even at "his" age. Sport, he says, and that's all he has to say. Well, I am forbidden to manufacture my own copy, so there. We have a fine story from *Kenneth A. H. Smith*. He is still holding forth as Technical Staff Consultant for the Navy Security Engineering Facility in Washington, and thus travels all over and a lot. Ken lost his wife a few years ago, and calls himself a bachelor. Both his children are grown; daughter married with the first grandson on deck, which makes Ken a full member of the Grandfathers Club. Son (name?) is in the Air Force and is stationed on Formosa. Thanks, Ken, for such a nice news capsule. From another, *Smith J. Terry*, we get another Capsule, but, J. T. wrote us about his change long since, and we did include it before. Quickly, he retired, then went back to work at the San Francisco Naval Shipyard as a Marine Engineer. I did ask what a Marine Engineer is, but no reply yet. From *Fred Walker*, of Denver, comes another short one. I talked via phone with Fred last February, or was it January, Fred? However, I am not sure that he is in Denver as he is stopping landslides on the Columbia River, Corps of Engineers, and is building a six mile dam out of waste materials. Also, he keeps an eye on several reservoirs in order to establish what it is that causes landslides, and he tries to figure out corrective measures. Great stuff, Fred, and, if you do have an address change, send it in to the Alumni Office. They will notify us. Many thanks for your message. Last of the

capsules, but not least, is from another Vice President, *William E. Rand*. Bill comes through with no message except that he has changed his address again, and, he asks the Fund to notify me that he will write very soon (date, October 28, and no letter yet). I await the letter and the reason for all this moving, Bill, and don't forget that you are my official foreign office man from California. Please include a lot of info on classmates, you Veeps must do something to earn the title.

Folks, I have just returned to Florida from Chicago and the International Livestock Show; an annual joy. Immediately on arrival at O'Hare, I phoned *Cal Mohr*; got a list of six or more Chicago classmates, complete with phone numbers, and, made a luncheon date for Tuesday, December 3. I phoned four of the classmates Sunday afternoon between games, and talked with all four, but could not stir up an answer at the other two numbers. First is *Hollinshead Martin*, hereinafter called Gus, and one may see why Brenda Kelley abhors nicknames. Gus says what would you do with a given name like Hollinshead? It seems that Gus and Eleanor each have two daughters, and one daughter is married and lives in Chicago's Greenwich Village. I asked if that might be malarkey, and Gus said no, there is such and it is somewhat bohemian. We had a fine personal chat and, as usual, I forget it all but enjoyed every second of it. Gus asked me to quote him, "Give my very best to all the boys." Next came *Harry Summer* early and late of Larner Shops, Chicago. The Summers have a son at the University of Illinois, and another in high school, probably Evanston, where they live. Again, we did plenty of talking and enjoyed it immensely. Harry did say that they see, or used to see, a lot of *Mel (Melville) Ehrlich*, presently a New Yorker, with Mobi'oil, and I quote Harry as saying that Mel is a grease-monkey. My, my! Other than that the Ehrlichs have three youngsters, we found out little more. So we await Mel's story. That greasemonkey out to flush him out! Next came *Louis Alpert*, who had quite a story on his good wife, Bea, and the three children. Myrna is married and has one child; Susan is also married but has no children yet; Edward is in high school, one of which I had never heard, the High School of the University of Chicago. Louis is still with American Smelting of Whiting, Ind., where he goes via the expressways every day in 20 minutes. These Chicago expressways are really marvelous. Finally, I did hit pay dirt when I called *Larry Jacobson*, though not all via the phone, as Larry wrote me a letter right away. So, I combine the phone and the letter. Larry and Belle have four children, two sons and two daughters. One daughter, Diane, a graduate of the University of Michigan, is married to a Professor of Math at Illinois. Freya graduated from the University of Illinois and is married and living in Los Angeles. Her husband is an attorney with the State Attorney General's Office. Golly, I dang well

nearly made one big faux pas; there is another daughter, Susan, who is married and living in San Francisco, and is finishing her education there. Son Michael graduated from the University of Chicago and studied at the Salk Institute. He is now at M.I.T. working towards his Ph.D. in molecular biology. Son, Jeffrey, is with VISTA, the domestic Peace Corps, and he graduated from Illinois. Larry himself spent his first four years out of school in geophysical prospecting, then five years in electromagnetic device engineering in Chicago, and has since then been doing a lot of writing, publishing, and advertising in the photographic field. His stationery is headed Camera Gazette Publishing Company, Chicago. Larry, that is great and I make haste to thank you a thousand times over. You don't write much, but you write well. How unfortunate it is that I just cannot report verbatim on my three hours with *Cal Mohr*, the following Tuesday, December 3, 1968. Cal, as always, is and was most charming. We had an excellent lunch then went to our suite and just raked over old times to a farethell.

A full report of our conversation would fill the 1933 column all by itself. We did agree on one item, rather than have the *Review* come out without our class news, Cal agrees to write the column if I am ill or cannot make it. This almost became a reality a month ago, when I scraped a shin, and, it would not heal. I had to go to a hospital for treatment, and feared that I might not write this column. Anyway, we will ask *Jim Turner's* permission to set up an alternate system, where Leona can send Cal the material, and he in turn, will write it up. Fellows, I can assure you that Cal could do a better job any time than I can, and, no one ever accused me of being bashful. Cal has a National American Society of Chemical Engineers Meeting coming up, Houston, I think, and he will come back with a whole raft of material. Cal is by far our best correspondent. Cal asked that I carry his best to y'all in this February bit, and I hereby do. Cal, I loved every minute even though I did dang near fall asleep on ya.

Classmate deceased

The Alumni Register informs us of several deaths, but, all but one has been mentioned here before. That one is *William H. F. Carberry*, of Franklin, Mass. We have no details other than that Bill passed away May 17, and, we or the Institute were not notified. This is deplorable, but we cannot control it. Our deepest sympathy in which our whole class joins, goes to Bill's loved ones.

Before the addresses we have one item of interest; *William H. Barker* of Warwick, R.I. represented the Institute at the Inauguration of the new President of Rhode Island College on November 7, 1968. This, friends, is an honor. Do not ever turn it down, if offered.

Addresses are changed for the following: *Charles G. Anderson*, *Jack F. Andrews*, *Ellery D. Clark*, *Ralph E. Cross*, *Robert*

Dillon, Gilbert A. Gerridge, Wolfgang M. Kloenne, Lewis W. Morre, Kenneth D. Moslander, Edmund B. Norman, Emerson S. Norris, William E. Rand. Please be assured that these new addresses and all others are available to classmates, provided they write a letter asking for one or more and include some news for the *Review*. This, we submit, is far too little to ask in return for sending out addresses. Don't forget the 40th reunion coming up soon, and this includes the 40th Fund. Every dime, starting last July 31, goes to the credit of the 1933 40th Fund. We hope to make it the biggest ever. Just write to Ken Brock or *Ellis Littmann*.—Warren J. Henderson, Secretary, Fort Rock Farm, Drawer H, Exeter, N.H. 03833, or, this winter, 1079 Hillsboro Beach, Pompano Beach, Fla. 33062

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The highlight of this month's mail was the following letter from *Ham Dow*: "It has been just two weeks since Edith and I returned from a fabulous three-week tour of the Orient. We left the U.S.A. at Seattle; flew direct to Tokyo; spent a glorious week in Japan; on to Taipei, Taiwan for an overnight stop; thence to Bangkok, Thailand via airport stops at Okinawa and Hong Kong for three days; back to Hong Kong for five days; then to Honolulu via Tokyo for a final five days before returning home. We enjoyed all of the places we visited, the people, the sights, the shopping, and the friends we met in the tour group who were primarily M.D.'s on The National Allergy Seminar Tour. Japan, where Edith and I took a separate side trip to visit the Atomic Power Plant being built by G.E. at Tsuruga on the shore of the Japan Sea, was our favorite of all.

"I can write you columns of details on the trip; but lest I spoil it for others who may be fortunate enough to follow us there, let me just report that the highlight of our trip was being entertained by classmate *Willie Dunn* and his wife *Elsie* while we were in Honolulu. Despite her recuperating from a recent stroke, *Elsie* was most gracious to us, baking us her Pillsbury-General Electric prize-winning cake, while *Willie* took time to show us the sights on Oahu Island. Their two daughters, *Elaine* and *Gladys*, are now living near us in California and their son, *Sam*, is in service in South Vietnam. We hope to persuade *Elsie* and *Bill* to move near us here in California now that their children are all away.

"The 'lowlight' of our trip was my contracting dysentery, which curtailed my activities during the last week, and from which I am only now fully recovered. I philosophize that it was nature's way of helping me avoid adding too much weight as we literally ate our way around the Orient. I did recover enough to play a round of golf at the Waialae Golf Club that beckoned so invitingly outside our room at the Kahala Hilton,

where the Hawaiian Open Tournament had ended just before we arrived.

"In the 'small world' department, our daughter, *Merrilyn*, who graduated from Oberlin's Conservatory of Music last June and is now teaching Piano at the University of Arizona, while working for her Master of Music, called us the day before our trip to tell us that her new friend, a student there, reported her parents would meet us and entertain us in Hong Kong. They are friends of a mutual close friend living in Quincy, Mass., who had written to them of our going there. They did meet us and made our visit to Hong Kong most pleasant. We also discovered that some of our fellow tourists, most of whom were from the Greater Boston area, knew well a North Shore restaurateur who once courted our older daughter, *Jocelyn*, when she attended Boston University. Yes, it's a small, small world!

"We have *Irving* and *Anni Banquer* to thank for our going on this trip to the Orient. They had originally signed up to go, but cancelled out. Our mutual friends wrote and mentioned it, asking us if we'd like to come along in their place, since we had hoped some day to visit Hawaii, where the tour was scheduled to end. Incidentally, the *Banquers* will visit us in January en route to a three-week stay in Hawaii; perhaps they'll meet the *Mowatts* who will also be out here about that time." Co-Secretaries—*Phoenix N. Dangel*, 329 Park Street, West Roxbury, Mass. 02132; *Irving S. Banquer*, 20 Gordon Road, Waban, Mass. 02168

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With apologies for the silences your secretary will try to get back "in the groove." I miss the card from the previous editor, which I placed in a prominent spot on my desk to remind me of deadlines. . . . My conscience was pricked by a letter on the stationery of the Kuwait Sheraton from *Roman Ulans* who writes that he carries unread issues of the *Review* on his trips of which he makes about four a year as far east as East Pakistan. He is working on the commercial global satellite communications system. "There will be eleven earth stations in ten countries out here by the end of 1971. There are four under construction now with the rest in various stages of the pre-contract phase. Kuwait should have its earth station in service by July, 1969." The retired Colonel joined Com Sat in September, 1966.

A double vote of thanks

Along with their contributions to the Alumni Fund came notes from the following who deserve a double vote of thanks: *Gerry McMahon* reports no change in status since his last report, "same family—same job—just a little older." *Laddie Reday* spent the summer in England, Italy, Greece and Ireland with his family, visiting a daughter in Positano Art School and "drumming up

business for American Water Products Corporation, my firm on the west coast." *John Myers* moved in August from Lockheed in Sunnyvale to Ampex where he is Pricing Manager for the Instrumentation Division. *Louis Proulx* addressed the New London (Conn.) Section of the A.S.M.E. in November. He is chief of the state Air Pollution Control. *Melvin First* is Associate Professor of Environmental Health Engineering in the newly named Department of Environmental Health Sciences at the Harvard School of Public Health.

Classmate deceased

I regret to report that *Edward Targonski* died in Muncie, Ind., on August 31, after a long illness. He had been associated with Maxon Premix Burner Company since 1950 as Chief Engineer. He was a Deacon of the First Presbyterian Church and had been active in Boy Scouts for several years. He is survived by his wife, *Yevive*, a son, *James S.* (15) and a daughter *Kathryn J.* (13). His home was at 1007 Shellbark Road, Muncie (47304).—*Alice H. Kimball*, Secretary, 20 Everett Avenue, Winchester, Mass. 01890

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Herman Brettman has been elected Deputy Chairman, Irish National Bank, main office Dublin, Ireland. They expect to have branches in New York, Washington, Virgin Islands and elsewhere. His son, *Lee*, is a senior at the Institute and is heading for medical school. *Dave Summerfield* was recently promoted to Director of Research, Skil Corporation. His older son, *Steve*, was married in January 1968 and his younger son, *Gary*, is completing his law degree at the University of Tulsa. *Ed Corea* is Supervisor of Shipbuilding of the General Dynamics Shipyard, Quincy, Mass. His daughter, *Virginia*, is a Lieutenant U.S.N. (nurse corps), stationed in Naples; daughter, *Elizabeth*, is at University of Mass., working for her master's degree in speech; son, *Edward Jr.* is a freshman at University of Mass.; daughter, *Rosemary*, is a junior at Boston State; and daughter, *Genoveffa*, is working in Athens, Greece. *Carl Megquier* has recently retired from the American President Lines, Ltd. after 30 years of service. He has made no definite plans and is living at The Kenilworth Apartments 3X, 142 Garth Road, Scarsdale, N.Y. 10583.

Walt Sherry is President of the Erie County Chapter of N.Y. S.S.P.E. His daughter, *Carole*, is spending six months in Europe and his daughter, *Lynda*, is a junior in Syracuse, School of Journalism. *Walt* and his wife, *Joan*, have just completed a trip to Hawaii and are planning to attend our fall weekend in 1969. *Jim Newmans's* daughter, *Phyllis Waldmyer*, was married in September to *Geoffrey Thorne Dunbar*, in Trinity Church, Branford, Conn. This is the first offspring of the *Newmans* to be married. *Nancy Klock* is still teaching electrical engineering at the University of Hartford. Last summer

she traveled to Arizona with two of her sons and their wives and recently to Europe and Russia with her third son and his wife. *Al Woll* became a grandfather when his daughter, Helain W. Fendelman presented him with a grandson on September 8th in Scarsdale, N.Y. *Jack Simpson* was married (wife's name Stevie) July 5, 1968 on the Ohio River. *George DeArment*, Special Gifts Chairman, for the Erie District, has already exceeded his goal with a result of 113 per cent. Our President, *Phil Peters*, has informed me that he has regretfully accepted the resignation of *Len Seder* as Class Agent and is pleased to announce that *Art Zimmerman* has agreed to assume these responsibilities. Art will do his usual excellent job and it is up to all of us to help him by participation in the Alumni Fund.—*Robert H. Thorson*, Secretary, 506 Riverside Avenue, Medford, Mass. 02155; Professor *Curtiss Powell*, Assistant Secretary, Room 5-325, M.I.T. Cambridge, Mass. 02142; *Jerome Salny*, Assistant Secretary, Egbert Hill, Morristown, N.J. 07960

38

News is sparse this month. However, I have established that I have at least one reader—my wife, Sandy. Referring to the December class notes which mentioned an M.I.T. cocktail party at the Whitney Museum, I received an anguished complaint that she was not named as being present. To my one reader, my public apologies—she, like Kilroy, was there. If any of you do read this, I'll print news, scandal, apologies, and, for a modest contribution to the Alumni Fund, ads.

It's in the family

A lengthy note from *Ed Hadley*: "Our son, Peter, has become the fourth Hadley to matriculate at M.I.T. We are now represented in the classes of '05, '38, '65 and '72. Pete has pledged Sigma Chi—his new brother-in-law wrote a much better letter than his father or his Hamilton brother. (Actually he fell in love with the Sigs, or the Sweetheart thereof, and closed his eyes to the other houses.) Now the Sigs see the result of an M.I.T.-Wellesley marriage. They're starting to date Simmons, Radcliffe, etc. . . . Sue and Bill are living in Winthrop, Bill in third year of BU law and Sue putting him through, as a physical therapist in a Lynn hospital. George still on SST with Boeing; and Dick a Lt. (j.g.) under water somewhere in the Pacific."

Fred Ray writes that he has completed 30 years with Mobil. Current position is Manager of Facilities Division, Engineering Department, Mobil R & D Corporation. His recent activities included a study to move the Engineering Department to Princeton, N.J. Results affirmative, with move scheduled for mid-1970. His son is graduate floriculturist but now completing three years in the Signal Corps, with the last two as Lt. in Germany. Daughter is teaching science and chemistry at Irvington, N.Y. and getting M.A.T. at Columbia.

Welcome Bender reports: "Present activity is as Technical Director, Science, Planetary Systems, Martin-Marietta in Denver, concerned with the scientific experiments on the 1973 unmanned mission to Mars."

Environmental health hit the news as far as '38 is concerned. Two items: *Fred Viles* is involved as a Research Associate and lecturer on Industrial Hygiene in the Department of Environmental Health Sciences "at the Little Red School House up the river." Fred presently lives in Norwood, Mass. *Dick Henderson* heads an Industrial Hygienist team for Olin in New Haven. Task is to study and control the environmental factors affecting the health of employees, not only for New Haven operations, but also for Olin plants throughout the United States and, occasionally, abroad.

Al Wilson and I represented the Class at the December Alumni Council meeting. I saw *Paul Des Jardins* at a New York meeting last week. Paul is presently with Studebaker-Worthington and apologized for missing the 30th reunion. Further, he stated he has marked down the 35th (1973) in his engagement book. You might follow his example.—*Armand L. Bruneau, Jr.*, 550 Broad Street, Newark, N.J. 07102

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If brevity is the soul of wit, our comments this month will be extremely witty. *Henry Singleton*, who was a founder and is chairman of Teledyne, Inc., has been elected to membership of the Board of Trustees of the California Institute of Technology. *Stewart Miller* is the author of an article in the *Bell System Technical Journal* entitled "Solutions for Two Waves with Periodic Coupling." Stewart has been with Bell Laboratories since 1941.

Federal funds and the university

Herbert Holloman has launched into his new position as president of the University of Oklahoma by cajoling 572 people, including students, faculty, alumni, legislators, and business and cultural leaders to prepare a report on how the university can be improved. A novelty in the report is the suggestion that the university be less beholden to the Federal Government and that only federal projects should be accepted which will directly relate to the university's goal. It has long been your secretary's view that a college which is too dependent on federal grants for the running of its programs cannot have the necessary independence of operation that is so important to an educational system in a non-totalitarian society.—*Alvin Gutttag*, Secretary, Cushman, Darby & Cushman, American Security Building, 730 15th Street, N.W. Washington, D.C. 20005

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John W. Ludwig has been advanced to the position of Vice President Advanced Systems at Vought Aeronautics Division, LTV Aerospace Corp., Dallas, Texas. He has moved to Richardson, Texas. *Herbert R. Moody*, special gifts chairman for the Houston-Beaumont area of Texas has exceeded his area goal by 203 per cent. *Howard W. Samuels* and his wife were recent visitors to Israel where they had the honor of planting the first tree in memory of the late Senator Robert F. Kennedy in the John F. Kennedy Freedom Forest of the Jewish National Fund in Jerusalem. The M.I.T. Club of Mexico City has announced its Twenty-First Annual M.I.T. Fiesta in Mexico City to be held March 13-15, 1969 with an invitation to alumni and wives. For details write to the club at Reforma 116-804, Mexico 6, D.F., Mexico.

Darkly Wise and Rudely Great

Robert L. Sinsheimer is the author of an article entitled "Darkly Wise And Rudely Great" which appeared in the May issue of *Engineering and Science*. The article is based on insight obtained from his work in synthetically producing the DNA of the virus Phi X 174 for the first time. In his words: "This synthesis has conceptually bridged the long-mysterious gulf between the world of the living and the non-living and thus permitted an easy acceptance of the continuity between the inanimate and the animate matter, based upon a calm understanding of the potential for life inherent in molecular organization." He then goes on to show the similarity and differences of the Amino Acid Chains in various animals and plants, tracing the evolutionary relationships demonstrating the universality of the detailed structure of their common proteins. With this knowledge solidly grounded in physics and chemistry he believes: "Modern biology is now poised to provide a new and profound approach to the understanding of the nature of man."—*Walter J. Kreske*, Secretary, 53 State Street, Boston, Mass. 02190; *Everett R. Ackerson*, Assistant Secretary, 831 Cranford Ave., Westfield, N.J. 07090; *Michael Driscoll*, Assistant Secretary, 63 Center Street, Nantucket, Mass. 02554

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First, three items from the *Wall Street Journal*. *Wallace Murray* has been named Vice President of D. C. Heath. Wallace was formerly editor-in-chief of the publishing company. *Mort Goulder*, Senior Scientist at Sanders Associates has been promoted to Vice President of the firm. *Hugh Schwartz*, who was Vice President of Coca Cola Company's Minute Maid Division has been elected a Vice President of the Corporation and will be Director of Corporate Planning. More on Vice Presidents: *Milt Platt*, who is Vice President of Fabric Research Laboratories has been named Vice President of The Fiber Society; *Solomon Buchsbaum*

has been elected Vice President for research of Bell Lab's Sandia Laboratories at Albuquerque.

Lou Rosenblum has heard from **Nanu Amin**, who is well on his way to recovery after two eye operations, one in Bombay and one in Essen, Germany. Lou is expanding his photographic engineering activities in several new directions and has been helping to plan long term financing for Belmont's first wholly new school building in 34 years. A letter from **Dr. Marty Levine** (via Lou Rosenblum) tells of Marty's current activities. He is Assistant Professor of Radiology at Harvard Medical School and has teaching appointments at Tufts and at Boston University. He is also Deputy Director of the new Harvard Joint Center for Radiation Therapy which is a consolidation of the Radiation Therapy Departments of four Boston area hospitals; Beth Israel, New England Deaconess, Boston Hospital for Women and Peter Bent Brigham.

In the schools and miscellaneous courses department, **Alfred J. Frueh, Jr.**, left McGill at the beginning of this academic year to become Chairman of the Department of Geology and Geography at the University of Connecticut at Storrs. **Bob Rines** was a discussion leader at the Boston University, College of Business Administration conference on "Stimulating Innovation: An Examination of Management Attitude, Proprietary Policy and Creativity." **Donald H. Kern** attended the 54th Advanced Management Program at the Harvard Graduate School of Business Administration from September to December 1968.

News from the American Institute of Physics notes a collection of 23 articles from authors world-wide on "Infrared Techniques in Nondestructive Testing" edited by **Eric Wormser**. Recent class notes reported Eric's promotion to Executive Vice President of the Barnes Engineering Company in Stanford, Conn.

One more general officer credited to the Class, Colonel **Robert F. Long** promoted to Brigadier-General as Commander of Air Force Cambridge Research Labs.

Charlie Bossi represented M.I.T. at the inauguration of the President of Wright State University in Dayton, Ohio. In keeping with our practice of full disclosure of all news, Charlie is 5'-9" tall, weighs 200 pounds and wears a size 7½ hat! If any classmates wish to keep such statistics out of the public press (or at least out of the *Technology Review*), don't get yourselves appointed as an M.I.T. representative as measurements for academic regalia are required.

Model labor centers

A note from **Mark Kravitz** with a press release reports his appointment as Executive Director of the Shade Tobacco Growers Agricultural Association with headquarters in Windsor, Conn. He has been with the Association since 1953 originally as purchasing agent and superintendent of the Association's farm labor

camp operations. Mark has also worked with the Connecticut Labor Department in connection with the Puerto Rican and British West Indian Farm Labor Programs. His farm labor centers in Windsor and in Windsor Locks, Conn. have been copied as models by growers in many other areas.

Deepsea Ventures

A very interesting news release describes Tenneco's newly formed Deepsea Ventures, Inc., a contract research and development firm set up to find and evaluate mineral, animal and plant under-sea resources. **Jack Flipse** is President of the new operation and said that early programs include searches for under-water manganese-nodule deposits and associated nickel and copper and an evaluation of some shallow water alluvial deposits. In addition to extensive shore facilities, Deepsea Ventures has a 298-ton, \$1,000,000 "Prospector" converted and outfitted by Newport News Shipbuilding. The craft includes a chemical laboratory, an electronics laboratory, an underwater TV system capable of working in depths to 15,000 feet and equipment for evaluating the ocean floor and for taking core samples up to 150 feet below the ocean floor.

News of Fund contributors

From Alumni Fund contribution envelope flaps (a very good source of class news, but sometimes somewhat delayed) we learn that: **Myron Johnson** has been named "Lumberman of the Year" by the Western Wood Products Association; **Victor Frank** has been Director of Organic Materials Research at W. R. Grace Company's Corporate Research Center since 1962; **Albert E. Hayes, Jr.**, recently became a Registered Professional Engineer in California. He is operating a private consulting practice in communications, circuits, and systems; **Sanford Peek** is Manager of Applications for Sylvania Lighting Division. He has been working on new automotive headlight systems for better visibility and for better non-glare performance; **Antonio C. Kayanan** has finished two missions for the United Nations. The first was to assist the government of Zambia in planning and housing. The second was to Peru to assist in site selection for a model community near Lima and in a pilot study for urban development in old Lima. Thanks for all the news sent in this month. Let's hear more from you all!—**Ken Rosett**, Secretary, 191 Albe-marle Road, White Plains, N.Y. 10605

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Since notes were prepared for the January issue, two mailings have been received from the Reunion Committee of which **Burt Bromfield** is chairman. The first notice, received about December 1, asked class members to state their plans with regard to attending the 25th reunion to be held next June 13-16 on campus in Cambridge. The second notice, received in mid-December, requested class members to complete and return by January

15 a biographical data collection form from which to compile the 25th Reunion Book. When these notes reach you, responses to both mailings will be overdue. Nevertheless, **Stan Warshaw**, the editor of the Reunion Book (and our observer last year at the Class of '43 reunion), will presumably still welcome the biographical material and the photographs which have been requested. Consequently, classmates who have not yet responded are urged to do so. The incentive for responding to the Reunion Book editor is somewhat more compelling than that for responding to requests from the class secretary for news items: if the data for the Reunion Book is not submitted, there will be conspicuous omissions in the publication.

During the period of mailings for the 25th reunion, the function of the class notes appears to be that of making a permanent record of the proceedings for all interested including the members of more junior classes to assist them in planning their own reunions. Members of our Class will have received most information by direct mailings well before the notes appear. There is one area to which attention has not yet been given as indicated by the minutes of the Reunion Committee namely, the election of officers and other class business requiring formal action.

Class constitution proposed

When I accepted the job of secretary three years ago, I inquired about the existence of a class constitution. I was informed that none existed. In fact, according to **Fred Lehmann**, Secretary of the Alumni Association, there was no model or sample constitution for classes available from the Association. A uniform constitution is now available for M.I.T. clubs. I am current in that area, having just served as chairman of a Constitution and Bylaws Committee for the M.I.T. Club of Washington. Some effort along these lines appears to be in order for classes.

It is my understanding that classes are expected to elect officers at their five year reunions and it is my view that while club officers should be elected at meetings, serious consideration should be given to electing class officers by mail. Certainly if an argument can be made for electing club officers by mail, a much stronger argument can be made for such election of class officers. There are other possibilities, of course, including election at a reunion meeting where representation by proxy is permitted. However, in the absence of a constitution authorizing same, neither proxy voting nor voting by mail are permitted under *Robert's Rules of Order*, Revised (1951 edition).

Whether elections take place at a meeting or by mail, there are other questions relating to nominations and elections which must be resolved. Should a Nominating Committee be used? If so, how should it be named and when? **Robert** specifically recommends that the Presi-

FIFTH ANNUAL TOUR PROGRAM—1969

This unique program of tours is offered to alumni of Harvard, Yale, Princeton and M.I.T. and their families. The tours are based on special reduced air fares which offer savings of hundreds of dollars on air travel. The tour to India, for example, is based on a special fare, available only to groups and only in conjunction with a tour, which is almost \$400 less than the regular air fare. Special rates have also been obtained from hotels and sightseeing companies. Air travel is on regularly scheduled jet flights of major airlines.

The tour program covers four areas where those who might otherwise prefer to travel independently will find it advantageous to travel with a group. The itineraries have been carefully constructed to combine the freedom of individual travel with the convenience and saving of group travel. There is an avoidance of regimentation and an emphasis on leisure time, while a comprehensive program of sightseeing ensures a visit to all major points of interest. Hotel reservations are made as much as a year and a half in advance to ensure the finest in accommodations.

THE ORIENT

30 DAYS \$1549

Mar. 22, Jun. 28, Jul. 26, Sept. 20

1969 will make the fifth consecutive year of operation for this fine tour, which offers the true highlights of the Orient at a sensible and realistic pace. Eleven days will be spent in JAPAN, divided between TOKYO, the ancient "classical" city of KYOTO, and the FUJI-HAKONE NATIONAL PARK, with excursions to NARA and NIKKO. Five days will be spent in HONG KONG and four in the fascinating city of BANGKOK. Shorter visits to SINGAPORE and the lovely island of FORMOSA complete the itinerary. Optional pre and post tour stops may be made in HONOLULU and the WEST COAST at no additional air fare.

A complete program of sightseeing will include all major points of scenic, cultural and historic interest. Features range from a tour of the canals and floating markets of Bangkok, an authentic Javanese "Rijst-tafel" in Singapore, and a launch tour of Hong Kong harbor at sunset, to a "Mongolian Barbecue" in Taipei, and a trip on the ultra-modern 125 m.p.h. express trains of Japan.

Tour dates have been chosen to coincide with outstanding seasonal attractions in Japan, such as the spring cherry blossoms, and beautiful autumn leaves, and some of the greatest annual festivals in the Far East. Total cost is \$1549 from California, \$1719 from Chicago, \$1787 from New York.*

INDIA

Including NEPAL and PERSIA

29 DAYS \$1636

Mar. 15, Mar. 22, Aug. 2, Oct. 4

An unusual opportunity to see the diverse and fascinating subcontinent of



India, together with the once-forbidden kingdom of Nepal and the rarely-seen splendors of ancient Persia. Here is India from the mighty Himalayas to the palm-fringed Bay of Bengal: the great seaport of BOMBAY; the magnificent cave temples of AJANTA and ELLORA, whose thousand year old frescoes are among the outstanding achievements of Indian art; MADRAS, in the south; the great industrial city of CALCUTTA; a thrilling flight into the Himalayas to KATHMANDU, capital of NEPAL, where ancient palaces and temples abound in a land still relatively untouched by modern civilization; the holy city of BENARES on the sacred River Ganges; AGRA, with not only the Taj Mahal, but many other celebrated monuments of the Moghul period such as the Agra Fort and the fabulous deserted city of Fatehpur Sikri; the walled "pink city" of JAIPUR with an elephant ride at nearby Amber Fort; the unique "lake city" of UDAIPUR, with its delicate white marble palaces; the great capital of NEW DELHI; and the fabled beauty of the VALE OF KASHMIR, surrounded by the snow-clad Himalayas. PERSIA (Iran) includes visits to PERSEPOLIS, the great royal capital of Darius and Xerxes in the 5th century B.C.; and ISHFAHAN, the fabled city of the 15th-17th century Persian Renaissance, with its palaces, gardens, bazaar, and famous tiled mosques. Outstanding accommodations include hotels that once were palaces of Maharajas and luxurious houseboats on Dal Lake in Kashmir. Total cost is \$1636 from New York.*

SOUTH AMERICA

31 DAYS \$1599

Jan. 18, Jul. 26, Oct. 18

An original itinerary which takes unusually full advantage of South America's great scenic and cultural attractions. The trip descends along the West Coast, dominated by the towering Andes and filled with the churches and mansions of 16th and 17th century Spain, and returns through the modern cities and lush scenery of the East Coast. Stops include Spanish colonial QUITO, with the nearby Indian market at AMBATO and a drive along the snow-capped peaks of "VOLCANO ALLEY"; Pizarro's great viceregal capital of LIMA; the ancient city of CUZCO and the fabulous "lost city" of MACHU PICCHU; lovely SANTIAGO in Chile; cosmopolitan BUENOS AIRES, the continent's largest city; BARILOCHE, in the beautiful ARGENTINE LAKE DISTRICT; spectacular IGUAZU FALLS (largest in the world); the sun-drenched beaches of RIO DE JANEIRO (considered by many the most beautiful city in

the world); the quaint and historic town of OURO PRETO (so revered by Brazilians that the entire town is preserved by law as a national museum); the striking contemporary architecture of BRASILIA; and PANAMA CITY with the Panama Canal, Spanish ruins, and free-port shopping. These great points of interest are complemented by an assemblage of South America's truly outstanding hotels. Total cost is \$1599 from New York.*

EAST AFRICA

22 DAYS \$1549

Jul. 14, Jul. 28, Sept. 22

A luxury "safari" to the great national parks and game reserves of Uganda, Kenya and Tanzania. These offer a unique combination of magnificent wildlife and breathtaking natural scenery: great herds of elephant in QUEEN ELIZABETH PARK, in the shadow of the fabled "Mountains of the Moon"; a launch trip on the White Nile through hippo and crocodile to the base of the thundering MURCHISON FALLS; multitudes of lion and other plains game in the famous SERENGETI PLAINS and the MASAI-MARA RESERVE; the spectacular concentration of animal life in the NGORONGORO CRATER; tree-climbing lions around the shores of LAKE MANYARA; and the AMBOSELI RESERVE, where all types of big game can be photographed against the towering backdrop of snow-clad Mt. Kilimanjaro. Air travel is used where possible, enabling longer stays within the parks. Also seen are the fascinating capital cities of KAMPALA, NAIROBI and DAR ES SALAAM, the exotic "spice island" of ZANZIBAR, and the historic MOMBASA, a beach resort on the Indian Ocean, with its colorful Arab quarter and great 16th century Portuguese fort. Tour dates have been chosen for dry seasons, when game viewing is at its best. The altitude of most areas provides an unusually stimulating climate, with bright days and crisp evenings (frequently around a campfire). Accommodations range from luxury hotels in modern cities to surprisingly comfortable lodges in the national parks (some equipped even with swimming pools). Total cost from New York is \$1549.*

*Special rates from other cities on all tours. Tour cost includes Jet Air, Deluxe Hotels, Meals, Sightseeing, Transfers, Tips and Taxes.

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dent of an organization not be empowered to name the Nominating Committee or its chairman. It can be embarrassing to the President if a Nominating Committee which he named re-nominates him for President. Alternatives to a nominating committee are a nominating ballot or nominating petitions, either of which can be used in advance of the meeting. I discussed election procedures with *Marty King*, Fairlawn, N.J., at the Alumni Officers' Conference held last September. He was enthusiastic in supporting my suggestion that the preferential ballot system be used. Such a ballot permits transfer of votes to achieve a majority in filling each position thus eliminating the need to accept a plurality as the final result or to reballot in order to achieve a majority, a consideration especially important if elections are conducted by mail. A sound nomination and election procedure, properly carried out, should result in a greater sense of commitment by officers to the class and by class members to their officers. I recently gave a talk to the D. C. Chapter of the American Institute of Parliamentarians (of which I am secretary) on "The Application of the Transferable Vote Principle in Nominations and Elections." Having mentioned the A.I.P., I should like to quote from the action program, which is the permanent platform of the Chicago based organization. "The general purpose of the A.I.P. is to work for improvement of parliamentary procedure to the end that decisions will be made by parliamentary means rather than by violence or dictatorial action, and that mankind will live in peace through the effective implementation of sound democratic principles." In using this forum to speak on behalf of democratic principles I am doing "my thing."

Doing his "thing"

We have another classmate who has been doing "his thing" for the past 15 years. *William D. Bowen*, Course II, 2481 Longfellow Street, Detroit, Mich., is the featured subject of an illustrated article in the December 1968 issue of *Ebony* (pages 76-78). Frankly, I did not recognize Bill as a classmate either by picture or by name, I planned to send the article to the appropriate class secretary but found that he is one of our own. Bill is an automotive aerodynamicist at Ford Motor Company's Research and Development Center in Dearborn, Mich. Although he took his degree at M.I.T. in fluid dynamics and heat transfer, he was interested in aerodynamics while a student. After graduation he joined the staff of the National Advisory Committee for Aeronautics (NACA, now NASA). He says he liked the work but the military overtones of NACA began to wear him down. He is quoted in *Ebony* as follows: "I didn't want to spend my life in a military orientation, that is, I didn't like spending it in something with the ultimate objective of killing people." Consequently in 1950 he moved to the heat transfer department of Ford where he continued the specialty he had developed at NACA. He researched and

tested auto radiators but not for long. In 1953 Ford was struck with an "unprecedented calamity," according to *Ebony*. The 1953 models, equipped with a more powerful engine than that used in the previous year's model were not as fast as the 1952's. Testing showed it was aerodynamic drag that slowed the '53 Ford. The company set out to discover what else the air could do to a car's performance. Bill, long interested in aerodynamics, was enrolled in the investigation from the beginning. In the past 15 years he has studied about 50 auto body types and has the position of senior research engineer in charge of the design center's aerodynamics section. Testing is done at the University of Maryland wind tunnel using three-eighths size models costing about \$7000 each. The work of the auto aerodynamicist today insures adequate stability in almost all wind conditions in addition to reducing noise and improving economy. For Bill, this means fulfillment—a successful transition from engineering aimed at military hardware to innovations in auto building that mean greater safety and comfort and more utility.

In the news

From the clippings we have additional news items. *J. Ross Macdonald* has been elected as a director of Texas Instruments, Inc., Dallas. He continues as director of corporate research and engineering. An impressive biography for *Robert J. Dew Jr.*, (with Sc.D. in III), appears in the October 1968 issue of *Flacs* (Florida Section of the American Chemical Society) in connection with his candidacy for the position of Councilor in that professional society. A few highlights from the biography are as follows: Bob was made head of the Department of Chemistry at the University of Tampa in 1955, a position which he held until 1964 when he resigned to set up his own consulting laboratory on a full time basis.

From the *Wilmington Evening Journal* of October 17, 1968 we learn that *Robert J. Reilly*, Vice President and Treasurer of Atlas Chemical Industries, Inc., was on that date elected a director of Delaware Trust Company. Bob has been with Atlas for 15 years. He joined the company as an industrial analyst and later headed the economic evaluation department. He was elected treasurer in 1957 and continued to hold that post when elected vice president in 1961. . . . *Henry C. Bourne, Jr.*, is the senior author, not of one, but of two highly technical articles in the September 1968 edition of *IEEE Transactions on Magnetics*. The short titles are "Kerr Magneto-optic Study of Propagation Phenomena" and "Wall Streaming, Creeping, and New Parade Motion."

Changes of address

Changes of address have been received for the following and, in accordance with the Warren J. Henderson, Secretary, '33, formula the new addresses are available on request: *Jose M. Aguila, Jr.*, *John R. Callahan, Jr.*, *Edward D. Chapin*, *Edward*

M. Coan, *John A. Conlin*, *Gerald Dennehy*, *Laurence A. Dirnberger*, *Roger M. Freeman, Jr.*, *Mrs. Asuncion Rivera de Armstrong*, *Scipio de Kantor*, *Peter S. Hopkins*, *Kenneth W. Joseph*, *Richard H. Lettan*, *Louis W. Maxson*, *Richard V. Mullikin*, *Willis T. Pettey, Jr.*, *Robert D. Remington*, *John E. Slifer*, *Charles L. Sollenberger*, *Ismail W. Tiner*, and *Edward B. Walker, III.*—*Paul M. Robinson, Jr.*, Secretary, Information Systems Division, Navy, OP-914H, Pentagon 2B330, Washington, D.C. 20350, 202-697-6115, or 7710 Jansen Drive, Springfield, Va., 22150, 703-451-8580; Assistant Secretaries, *Paul M. Heilman* and *John G. Barmby*.

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The National election is over and we can all rejoice in the realization that the politicians will no longer be thrust into our homes via the newspapers, magazines and television. The election does mean a change, people and the world are always changing. Only one thing does not change. Classmates still do not write to their class secretary.

Homework

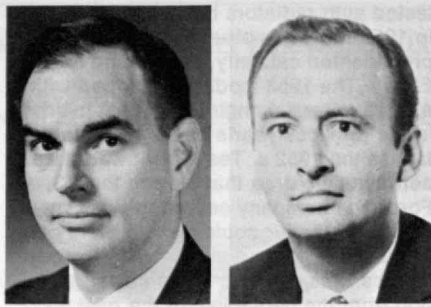
Perhaps a possible way to solve this problem is for me to assign homework monthly. I mean every month several members of the class will be assigned the task of writing and advising of their activities during the past year. This month I assign this task to *Roger Bart*, *Edward L. Belcher*, *Edward F. Brylawski*, *Don E. Burke*, *David M. Denzer*, *Howard T. DuBois*, *Harvey S. Freeman*, *Robert P. Fried*, *Stanley J. Goldstein*, *Robert Goodstein*, *Ted Henning*, *Richard L. Krahe*, *George Ley*, *Alfred A. Little*, *Gilbert Marr*, *Arthur Schiff*, *Arnold Whitaker* and *James R. Wilson*. Please respond promptly, gentlemen, the presses await your words.

Under the department of "Boy, are we getting old", we extend congratulations to the *Richard Yorgey* and *Robert L. White* families. These two members of the Class of 1946 have entered their sons in the M.I.T. fall term that began in September, 1968. *Robert White*, of 137 Buckhill Road, R.R.#7, Crown Point, Ind., has his son, *Peter W. White*, at M.I.T., and *Richard Yorgey* has a son, *Brian M. Yorgey*, of 328 South State Street, Ephrata, Pa., at the school.

Authors

The magazine, *Science*, had a very fine article by *Robert Mc C. Adams* of Course VIII, "Archeological Research and Strategies, Past and Present." *Dan Cooper*, Course VIII, and now a Ph.D. also has some excellent comments in the column, "In Our Opinion", written for the June, 1968 issue of *Science & Technology*. *Margaret G. deVries*, Ph.D. in Economics in 1946, has written an article entitled "The Magnitudes of Exchange Devaluation" for a recent issue of the *Fund and Bank Review* of the International Monetary Fund.

To F. B. Fairbanks, '52, and A. W. Collins, '49, the Review extends its apologies for the misplaced picture captions in the January issue. We take this opportunity to acknowledge that Mr. Fairbanks is, indeed, Mr. Fairbanks and that Mr. Collins is, indeed, Mr. Collins. Faux pas on us, gentlemen.



F. B. Fairbanks, '52 A. W. Collins, '49

We had the opportunity to read the summer issue of *Maritimes*, a magazine of the graduate school of Oceanography of the University of Rhode Island. It was our pleasure to observe that the Dean of the Graduate School of Oceanography is *John A. Knauss*, Course XIV, Class of '46, and a little old Detroit boy like me. It is stimulating to see so many of the class have received higher degrees and that so many are writing articles or publishing books on such a vast variety of subjects. A very talented group, and we are proud to be a part of you.

A new hotel for Harlem

Roger Sonnabend, President of the Hotel Corporation of America, announced the plans for construction of a new hotel. This type of announcement is not unusual news except that this hotel is to be constructed in Harlem, New York City. A special center for training local Negro and Puerto Rican hotel workers and management at all levels is an important part of their plan. This is the type of thinking and planning which is necessary to correct and eliminate the problems of the inner city. My congratulations to Roger and the Hotel Corporation for their forward thinking.

Until next month, health and happiness to all.—*Russell K. Dostal*, Secretary, 18837 Palm Circle, Cleveland, Ohio 44126

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As I sit down to write I realize that I am a bit late in everything including Christmas cards and shopping as well as these notes so brevity is the word.

Quickies

Sid Grob has left the clothing business and New England. He is now Vice President of Arlington Sample Book Company in Philadelphia. Good luck Sid in your new endeavor. *Mike Lagana* is now a full Colonel in the Army Reserve and a Vice President of the Kuhn, Smith, and Harris Construction firm in New York City. *Bob Blount* is still in the service being a Captain attached to the Joint Continental Defense Systems Integration Planning Staff. *Bob Ranan* is Vice President of Transiron, in Wakefield, where

he is in charge of the diode, rectifier and special products divisions.

Our moving members list *Tom Bell* to Lake Forest, Ill.; *Pirro Quamo* to Marblehead, Mass.; *Don Cottle* to Protsmouth, R.I., and *Dick Stanfield* to Festus, Mo. I don't know what you thought when you received *Jack Rizaka's* letter two months back listing the contributors to the 67/68 Fund but I'd think we could do better in 68/69.—*Dick O'Donnell*, Secretary, 28516 Lincoln Road, Bay Village, Ohio 44140

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Norman Champ is presently Vice President of the Champ Spring Company in St. Louis, manufacturing automotive leaf springs for the truck and trailer replacement market.

Mauricio B. Casanova is presently back at M.I.T. as a Fellow in the Center of Advanced Engineering Study. He is on sabbatical leave from the Universidad Central de Venezuela, where he is now Professor of Mechanical Engineering after teaching Power Generation subjects for 13 years. He has combined this almost simultaneously with 16 years of consulting work. His largest and most interesting project to date, as member of Oficina Tecnica Pieretti, is the Tuy No. 2 and Camatagua waterworks pumping systems for National Institute of Sanitary Works (INOS) which provides drinking water to a projected Caracas population of 3.5 million. This brought things to a full circle, having originally gone to Caracas to work for INOS after spending 1½ years in General Electric as a Test Engineer in Schenectady, Lynn and Philadelphia. *Mauricio* was Secretary of the Venezuelan M.I.T. Association in 1957-58. His wife, *Terry*, is from Salem, Mass.

Mr. William A. Price is employed by U.S. Army as a Structural Engineer Group Leader in the Galveston, Texas district office. *Joseph B. Oppenheim* visited his brothers and their families during the summer and fall of 1968, in Baltimore, Md., Washington, D.C., and Satellite Beach, Fla. He also stopped at his uncle's home in Boston, Mass. *Robert L.*

Plouffe, Course VI, joined the G. C. Dewey Corporation, 331 E. 38th Street, N.Y., effective October 12, 1968, as Vice President, Director of Engineering, having resigned from Stelma, Inc., Stamford, Conn., where he had held a similar post.

Founder, Director, etc., etc. . .

Robert L. Massard was Founder, Director, Vice President, Finnace & Treas., Computer Control Co., Inc., Framingham, Mass., 1953-1967, after acquisition by Honeywell, Inc. He is now Vice President and Director of Financial Technical Assistance Corporation, 60 Hickory Drive, Waltham, Mass. This is a small business investment company, licensed by the S.B.A. Fin-Tech was organized to provide financial support plus experienced management counsel to technology-based start-up small businesses.

S. M. Salomon is returning to New England to work for the Bird Machine Company in South Walpole, Mass., after living for eight years in the Midwest. For the past six years he has lived in Madison, Wis., where his wife, *Lucy*, obtained an M.D. degree. He commuted 120 miles a day to Beloit, Wis., working for the Beloit Iron Works (presently Beloit Corporation). He is looking forward to seeing old friends and browsing at the M.I.T. library.

R. L. Endres is currently employed as an Industrial Psychologist at the U.S. Air Station in Alameda, Calif. *Robert C. Michel* became President of River Edge Board of Education on July 1, 1968. He is currently serving on the National Society of Professional Engineers Ethical Practices Committee. *James A. Droble* was appointed Managing Partner, law firm of Schnader, Harrison, Segal & Lewis, Philadelphia in June of 1968. *Fred R. Messina* has been working for the last 10 years at the Polaroid Corporation in Cambridge, Mass. He is married to the former *Majorie Ann Jones* of Lowell, Mass., and has three children, ages 9, 10 and 11 Colonel *John C. H. Lee, Jr.* is presently winding up his work on the Appalachian Water Resource Survey—the first to estimate the full range of the economic effects of projects. *Henry C. Quigley* probably has the most recent first child of the Class of '50, *James A. Quigley*, born April 30, 1968.

John R. Flynn is with the Eastman Kodak—Apparatus Division, as Head of one of the Research/Engineering Department's Systems Engineering Groups. He spent from January through June of 1968 on special assignment recruiting professional personnel for the Research & Engineering Department. He was elected Program Vice President of M.I.T. Club of Rochester for the 1968-1969 club year. He says he has his original wife (Jane Train), 4 boys, 1 girl and 1 cat. *Edwin C. Kruse* was a delegate to the Democratic National Convention in Chicago, August 1968.

Ephraim M. Miller is a senior Instructions Writer on analog instruments at the Foxboro Company, Foxboro, Mass. In 1959 he married the former Mary Joanne Marsh, who had recently received an anthropology degree from the University of California at Berkeley. They are living in a spacious old house at 239 Clark Road, Brookline, Mass., with 3 children, 2 gerbils, about 700 books, and a grand piano. Among their interests are philosophy, psychology, world religions, and problems of modern industrial society. They are active members of Friends Meeting at Cambridge (they have both taught Sunday School and served as discussion leaders) and are happily involved in the operation of a cooperative nursery school.

After graduation, *James K. Blackard* started work in Chicago with the Turner Construction Company. After stints in Missouri, Nebraska, Wyoming and South Dakota, he went to Spain with the U.S. Air Force and was there from 1955 to 1966. He and his wife, Kay, celebrated their 21st anniversary on October 9. His son, Mike, who was born at Tech in 1949, is now a student at the University of Washington. They have three other children, two of whom were born in Spain.

After 15½ years with Olin Mathieson, *Raymond G. Hawes* is now Manufacturing Engineering Manager for the USM Fastener Company, a division of the USM Corporation (formerly United Shoe Machine Corp.) and is working at the Shelton, Conn., plant. He has three children; two boys, 13 and 10; one girl, 7 years old. They enjoy vacations travel-

ing and camping with their Apache tent trailer. *James C. McAllister* has completed 18 years at McDonnell Aircraft in St. Louis. He is now Chief Instrumentation Engineer for the McDonnell Douglas Corporation's Flight Test Division, as well as Corporate Radio Facilities Coordinator. He is reasonably active in the M.I.T. Club of St. Louis and the Educational Council. He has a wife, Hilde, and two boys, Clarke and Scott (11 and 9 years old). He keeps busy with Boy Scouts and Cubs.

David E. Webster was elected President and Chief Executive Officer of Tucker Manufacturing Corporation, with plants in Leominster, Mass. and Arlington, Texas. He wrote a book *To Love and to Cherish*, which has sold over 50,000 copies this year. He married Carole Pennington of Marks, Miss. He also won the annual Nantucket Backgammon Championship. *Joseph W. Saylor* is Manager of Systems Engineering for communications and switching at Sylvania in Needham, Mass. *Robert L. Miller* is presently a Senior Visiting Fellow at Manchester University, Department of Chemistry. He is on leave from Chemstrand Research Center, Inc., of Durham, N.C.

George C. Krusen is presently working with Coffin & Richardson, Inc., in Boston on industrial waste disposal problems. At his home in Boxborough, he is Chairman of a local Beaver Valley Project. They are trying to set aside about 300 acres, including the best example of a long straight esker in Massachusetts as a park area. They now have 70 acres. This esker is a gravel ridge laid down by the retreating glacier about 12,000 years ago. Others are after this gravel for construction material.

John C. Kern took his first trip to Japan in September to attend technical meetings with Hitachi through his joint company, Hitachi Perkin-Elmer. He enjoyed the experience in scientific interchange, as well as the unforgettable experience in super hostmanship. John says of Japan, "A remarkable country AND people."

Harry G. Foden, Course X, and *David B. McLeod*, Course XV, were selected as

two of approximately 162 business executives and government officials to participate in the 54th session of the Advanced Management Program (AMP) conducted by the Harvard University Graduate School of Business Administration. Each man is sponsored by his Company or agency, in the United States or abroad, for the 13-week course designed to prepare executives in or approaching, top management positions to exercise full leadership responsibility in an age of unprecedented change and challenge. Over 6,000 executives, government officials, or military officers have been graduated from AMP, the nation's oldest and largest resident management development program begun by Harvard Business School in 1943 as the pioneer university program of its kind.—*John T. McKenna*, Secretary, 2 Francis Kelley Road, Bedford, Mass. 01730

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Jack Barcinski is Marketing Vice President of Standard Brands Inc., Fleishmann Division in N.Y.C. he is living in Glen Rock, N.J., with his wife Joan and their two children. At a recent ceremony at Holloman Air Force Base, Dr. Alexander H. Flax, Assistant Secretary of the Air Force for Research and Development awarded the Legion of Merit to Colonel *Jack D. Beckelman* for outstanding performance in conducting classified tests. From Lincoln Mass., *John C. Champeny* sends one of the few negative votes on the new "unreadable" format for the *Technology Review* with a request to go back to a more easily scanned format. I don't know whether or not it is relevant, but John is with E.G. & G.

Melvin C. Chang, Sc.D. III, Manager of Process Development at the Dravo Corporation in Pittsburg, Pa., was chairman of the Raw Materials session of the AIME National Open Hearth and Basic Oxygen Steel Conference at Atlantic City in the Spring. Key papers were "Present State and Future Prospects of Sinter Plant Automation" and "Production and Performance of Carbonate Bonded Pellets." *William B. Ericson* writes that he, Carol and the three boys moved from Columbus, Ohio by way of Cape Cod to the Pittsburg Pa., area. His

To F. B. Falcenza, '52, and A. W. Collins, '49, the seven friends who gathered for the misadventurous protest against the January issue. We saw this opportunity in some way that Mr. Falcenza is, indeed, Mr. Falcenza and that Mr. Collins is, indeed, Mr. Collins. Four was an old, gentlemen.



F. B. Falcenza, '52, and A. W. Collins, '49

first attendance at the M.I.T. Club of Western Pennsylvania was a stimulating presentation on "Relevancy" by Greg Smith. He also had an opportunity to visit with *Elliot (Joe) Cutting* at JPL in Pasadena Calif.

Nathaniel C. Fowler is President of the Fowler Printing Co., Inc., in Needham Heights, Mass. He reports that his favorite hobby is making money for his five children. We'll have Fred Aldrich Check the Treasury for any foul Fowler bills. *John H. Healy* is living in Palo Alto with his wife Mary and their five children. He is with the U.S. Geological Survey.

Harold E. Jandebour retired as Lieutenant Commander, USN in June last year and is now assistant plant engineer for the Maremont Corporation, New England Division in Saco, Maine. His home is in Ogunquit.

E. Jonathan Leffler recently joined the Rouse Company, Baltimore, Md., as the project manager in charge of all commercial construction in the new city of Columbia, Md., between Baltimore and Washington D.C. *Lawrence Lortscher* is now manager of supply at the Chemicals Division of U.S. Steel Corporation in Pittsburgh, Pa. *Arthur B. Metzner*, Sc.D. X, a chemical engineer from the University of Delaware was the first recipient of the W. N. Lacey Lectureship at Caltech. *James P. Nolan, Jr.*, reports that his daughter Mary was married in June. He is a senior management consultant in the Office of Management Development at NASA Headquarters in Washington, D.C.

David M. Pellish is now assistant director of the National Commission on urban Problems. The Commission was appointed by President Johnson in 1967 under Paul H. Douglas, former Senator from Illinois. *Melvin R. Rubin*, S.M.I., is now with the Avco Corporation's Missile Systems Division in Wilmington, Mass. He is staff scientist in the Structures Department and reports that he is very happy with the work at Avco. *Louis Stern* has been named a partner of Dames and Moore, Consultants in the Earth Sciences, in N.Y.C. He lives in Summit, N.J., with his wife Mindy and their three children.

Rodwell V. (Rip) Todd is with Rummill-Hoyt, Inc., in N.Y.C. *Fred W. Weitz* is President of the Weitz Company Inc., Engineers and Contractors. He is living in Des Moines, Iowa with his wife Emily and their four children.—*Paul G. Smith*, 11 Old Farm Road., North Caldwell, N.J. 07006; *Howard L. Livingston*, Secretary, 358 Emerson Road, Lexington, Mass. 02173; Assistant Secretaries: *Marshall Alper*, 1130 Coronet Avenue, Pasadena, Calif. 91107; *Walter O. Davis*, 346 Forest Avenue, Brockton Mass. 02401

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Robert Anslow has been elected to the Board of Directors of Roanwell Corp. He is Comptroller of the Corporation. *Carl Bartow* is now working at Raytheon in Quincy after four years with Analex in Boston. He lives in Westwood, Mass., with his wife Virginia and three children; Lee Ann, Bill, and Mark. Carl received his masters degree from Northeastern in June 1967.

Bard Crawford completed his Sc.D. work in aeronautics and astronautics at M.I.T. in September and has recently joined the analytic Sciences Corporation in Reading, Mass. Bard, who previously worked on the Apollo Guidance System at the M.I.T. Instrumentation Lab., lives in Lexington with wife and four children, (three boys and a girl). *Themistocles Floridis* was one of thirteen American scientists to be awarded a North Atlantic Treaty Organization (NATO) Senior Foreign Fellowship last summer. Professor *Paul Gray* has been appointed "Class of 1922 Professor" at M.I.T. This Professorship was established for the purpose of rewarding and encouraging superlative teaching.

James McCauley was named Vice President of research, development, and engineering of the Crucible Steel Corporation. *Charles Masison* is technical manager for systems integration at Raytheon's Submarine Signal Division in Portsmouth, R.I. He commutes daily from Westwood, Mass., where he, wife Ruth and six children have settled in a new home. *John H. Moulton* reports that he is the grandfather of a beautiful baby girl and is still working at Curtiss-

Wright Electronics Division as a project systems engineer. *Andre Sampou* has been appointed manager of Manufacturing of Instron Corporation in Canton, Mass. He lives in Sherborn with wife and five children.

Army Major *William Hartrick* is attending a 38-week course at U.S. Army Command and General Staff College at Ft. Leavenworth. This course will prepare the students for duty as commanders and principal general staff officers at division or higher command levels. *Leonard Kranser* was appointed President of the Miller Dial and Nameplate Company, of El Monte, Calif., a subsidiary of Standard International Corporation where he served as director of engineering and assistant to the president.

Wins national award

Emil Krejci, Jr., won the 1968 Phi Gamma Delta National Award (Durrance) for the outstanding fraternity chapter advisor (Stanford University Chapter). Emil is operations manager for both Aquanautics, Inc. (manufacturer of air propelled hydrofoil vehicle systems) and Thunderbird Plastics, Inc. (manufacturer of non metallic composite structures). In November he, wife Shirley, and family moved into a new home in the hills of Los Gars. The Krejcis have three children; Sue, High School, Emil III, Junior High, and Stevie, 3rd grade.

Announcement and appointment

William Toole has announced the formation of a consultant service on urban problems to be located in Bloomfield, Conn. He will provide both public and private clients with specialized planning services. *Thomas Vasilos*, manager of Avco Space Systems Division materials sciences department, has been named to the ten member advisory committee for the Defense Ceramic Information Center.

At the conferences

Jerome Catz lectured on strain measuring systems and instruments at a seminar on strain gage techniques held at the University of Miami in January. *Donald Goldberg* and *Steve Poulos* participated in a "Specialty Conference on Placement and Improvement of Soil

to Support Structures" held at M.I.T. last summer. *F. B. Mc Kee* spoke at a conference on bearings held at Dartmouth College in September. He is with Airesearch Manufacturing Company. *R. C. Reid* was AIChE technical program chairman for a symposium on technological forecasting at the Tripartite Chemical Engineering Conference in Montreal last September.

Recent authors

F. A. Holden published "Static and Cyclic Fatigue of Alumina" in the proceedings of the seminar Structural Ceramics and Testing of Brittle Materials held at Illinois Institute of Technology in 1967. *M. Hillert* wrote on "Growth during Solidification of Graphitic and White Cast Irons" in a collection of papers titled *Recent Research on Cast Iron*. *Eric Laimins* published "Strain Gauge Transducers" in the magazine *Industrial Research*. *John Pierce* published "Limit Distribution of the Minimum Distance of Random Linear Codes" in the *IEEE Transactions on Information Theory*.—*E. David Howes Jr.*, Secretary, Box 66, Carlisle, Mass. 01741

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Many promotions, many children, many activities of various kinds to report.

Academics

Charles Ladd is back at M.I.T. full time professing civil engineering, having spent last year with Haley and Aldrich in Cambridge as a visiting consultant. He reports that "the experience was great, my debts are finally paid, but I did miss the captive audience. . . ." *Charles* participated in August in the Specialty Conference on Placement and Improvement of Soil to Support Structures sponsored at M.I.T. by the Soil Mechanics and Foundations Division of the American Society of Civil Engineers. *Tom Hamilton*, in his final year at the Business School at Harvard, has been named a Baker Scholar, a designation bestowed on the top 5 per cent of second-year students. Having retired from the Navy in June after 25 years of service, *Calvin Rakes*, N.E., has begun graduate studies at Stanford, working for a master's degree in education, majoring

in mathematics. *Bill Chandler* writes that he is working on his M.B.A. at the University of San Francisco, "something of a cultural shock to go back to school at this advanced age (but fun)."

Active for M.I.T.

John Erickson is President of the M.I.T. Club of Detroit this year while *Pete Toohy*, our Class Agent, and *Bob Craven*, Regional Chairman for Wayland, Mass., have been awarded certificates of appreciation for their outstanding efforts on behalf of M.I.T. in the 1968 Alumni Fund, two of 97 such awards.

Appointments and promotions

The General Physics Laboratory at the General Electric Research and Development Center in Schenectady, N.Y., announced in September the appointment of *John Houston*, Ph.D., as Manager of the Surface and Particle Physics Branch. The Houstons have two children. *Russ Meyerand* became Director of Research at United Aircraft Corporation in Hartford in November, and he and Mary Grace became parents in July, with the arrival of Beth. The Meyerands live in Glastonbury, Connecticut. In November *Gordon Lohman* was appointed President of the AMSTED Research Laboratories in Bensenville, Ill., a corporate arm of AMSTED Industries. Gordie, Jo Ann, and their two daughters live in Glen Ellyn, Ill.

Lawrence Hoagland, Sc.D., joined Energy Systems, Inc., in September as Vice President and Director of Research. The firm, engaged in the development of steam and vapor cycle engines of advanced design, has offices in Newton, Mass. In the Vacuum Equipment and Metals Division of the Norton Company, also in Newton, *Robert Lueders*, S.M., has been named Manager of Engineering. Thermo Electron Corporation of Waltham announced in August the establishment of three new operating divisions, two of which are headed by classmates: *Robert Howard*, S.M., is Vice President in charge of the Thermionics Systems Division; *Sotirios Kitrilakis*, is Vice President in charge of the Thermo-Mechanical Systems Division.

Dean Bensley, S.M., was named As-

sistant Manager of Raytheon's Space and Information Systems Division facility in Waltham in August, and likewise in Waltham in August *Dick DiBona* became Vice President of the Microwave Products Group of Microwave Associates. *Dick*, his wife, and their three children live in Wayland. *William Thoen*, S.M., has been named to the Planning Board of the Town of Ipswich, where he and his family have lived for eight years (there are three young Thoens now). In 1961 *Bill* was one of three founders of Lemessurier Associates, structural engineers, and has participated in the design of Boston City Hall and the new John F. Kennedy Building among other jobs. *Sol Krongelb*, Ph.D., is a Research Staff Member at the IBM Watson Research Center in Yorktown Heights, N.Y., currently investigating the properties of thin insulating films on semiconductor surfaces.

The Mutants

Joyce Davis of Teaneck, N.J., Certified Health Physicist with Burns and Roe, participated at the November meeting of the Greater New York Chapter of the Health Physics Society as a panelist in "an informal, musical panel revue of topics of interest for health physicists, their families and their associates," including "commentary on the Curie, radiation warning signs, . . . X-rays, color TV standards, grantsmanship, moonlighting and consulting, . . . nuclear shipping," etc., etc. The panel, known as "The Mutants," returned to New York to present "Health Physics on Old Broadway," having presented unique summaries in Houston, Washington, Philadelphia, Pittsburgh, Chicago and New Haven since its New York debut in 1965.

Perhaps some of these good notes written on the Alumni Fund envelopes would best be saved for a "rainy day" so that your southern correspondent can get the plum puddings made before Christmas (good recipe, courtesy of *Roberta Walker Stebbins* of Yerington, Nev. She and *Dick* are C.P.A.'s there, ranchowners, and parents of young *Richard*, one in January.)—Secretaries: *Dell Lanier Venarde* (Mrs. J. H.), 16 South Trail, Wilmington, Del. 19803; *L. Dennis Shapiro*, Aerospace Research,



Inc., 130 Lincoln Street, Boston, Mass. 02135

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Seven classmates gathered at the Alumni Fund office on December 3 to participate in the fall telethon. Joining your co-secretaries were *Jay Ball*, *Lloyd Brace*, *Paul Brown*, *Curt Burrows* and *Roy Mennell*. Together they attempted nearly 140 calls and got through to ninety classmates. As a result, the Alumni Fund is ahead by some 75 pledges, and your co-secretaries have some fresh news to report.

Three of the callers have recently become entrepreneurs—and all in the computer field! *Lloyd Brace* reports that response is growing to the new ideas of Information Transfer, a firm involved in the field of computer-aided teaching. *Jay Ball* is also involved with computers, but in small system hardware. The new firm with which he is associated is called Data Synectics. *Roy Mennell* has recently struck out on his own to begin a firm dealing in the development of proprietary software under the name Commercial Systems, Inc. Incidentally, he and Elaine are now parents of five.

Quickies

Lasell Junior College in Newton, Mass., has announced the election of *Bruce Bredehoft* to its Board of Directors. . . . *Wing Tsang*, who has been with the Bureau of Standards in Washington for several years, reports he has bought a home in Gaithersburg, Md., where his family now includes a wife and three daughters. . . . *George Luhrmann* is in his last year of residency at the Psychiatric Institute at Columbia University, and plans to begin teaching there next year. . . . *William Horton* is a design engineer with Goodrich, lives in Stow, Ohio, and has five boys. . . . *Tom Hoffman* works for Celanese at Narrows, Va., and is involved in quality control of their acetate process. He and Dianne have a girl and two boys.

Robert Hatcher has departed Tampa for a one-year assignment at Fort Leavenworth, Kansas. . . . *William Quam* is

pursuing cancer research with EG & G, and lives in Santa Barbara. . . . *Albert Schallenmuller* lives in Littleton, Colo., and is doing work on crew safety for the Martin Company in connection with its MOL Project. There are three little Schallenmullers, now. Al reports seeing *Don Bressler* who is back in school, working on a Ph.D., in Physiology at the University of Colorado. Another student is *Emmanuel Miliaras*, who is finishing work on his engineering degree while living in Winchester.

James Stenborg and his wife are parents of two girls and a boy, and live in the St. Louis suburb of Kirkwood, where Jim is Supervisor of Projects Planning for Monsanto. . . . *Angelo Perciballi* is at the Raytheon Laboratory in Bedford.—Co-secretaries: *Bruce B. Bredehoft*, 16 Millbrook Road, Westwood, Mass. 02090; *T. Guy Spencer, Jr.*, M.I.T., Room E19-439, Cambridge, Mass. 02139

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Jim Chorak dropped by our flat for a drink a few weeks ago. He was in London on business for Hughes Aircraft Corporation. After submitting to the indignity of posing for a photograph (reproduced here) Jim provided the following news: He is now completing his doctorate in Business Administration with a dissertation entitled: "General Model to Solve Problems in Balance of Payments in Internationally Funded Programs." Jim is involved in this subject in his work with Hughes. He and his wife live in Miraleste, Calif., (above the Los Angeles smog) with their two "princesses" and a "shoe-less commando." Jim's wife, an equestrian, is teaching the children to ride; they have two ponies. Jim is on the Republican State Central Committee and is 2nd Vice President of the M.I.T. Club of Southern California (after three years as treasurer.) He has been with Hughes for nine years, "Not bad for a temporary job." From Jim I learned that *Brooke Anderson* is Manager of South American operations for Upjohn and, when not travelling, resides in Houston. Also *Cort Ross*, Jim said, is with Lockheed in Sunnyvale working as an economist

on various Federally-financed poverty projects.

From the mailbox

David Freedman, in a cryptic note, advises that he is employed by IBM as a systems engineer. . . . *Frank Whitson*, is Associate Professor in the University of Texas' School of Architecture and has a private consulting architectural practice. He has two sons. . . . *Robert Bridgham* finished his Ed.D. in Science Education at Harvard's Graduate School of Education in June of 1967 and is now Assistant Professor at Stanford's school of Education. . . . *Alan Esbitt* is Director of Engineering in the Semiconductor Division of General Instrument Corporation.

A brief note advises us that *Kyu Lee* returned to Seoul, Korea with his ailing father, former Crown Prince Eun Lee in 1963. He worked with the firm of I.A.M. Pei and Partners in New York for six years before his departure to the Far East. He is now Vice President of Trans-Asia Eng. Assoc. Inc., and resides in Seoul with his wife, Julia.

Recent publications by classmates include: "Laser Machining of Thin Films and Integrated Circuits" by *M. Cohen* (*Melvin* is now with Bell Labs. He received his Ph.D. from Rensselaer in 1964.); "Understanding Sheet Metal Formability" by *Stuart Keeler* who is Supervisor, Flat Rolled Products Applications, Research and Development for the National Steel Corporation in Ecorse, Michigan; "Data Transmission Through a Random Noisy Channel by PAM" by *Donald Tufts* (Don is Professor of Electrical Engineering and Computer Science at the University of Rhode Island); and "The Myths of Research Management" by *Ed Roberts*. . . . A final note: Betty and I are the proud parents of a girl, born on Thanksgiving Day—*Frederick L. Morefield*, Secretary, 18 Whaddon House, William Mews, London, S.W.1.

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Another month, another column . . . You guys are going to get spoiled at this rate! I really think that I'm going to have

to skip a couple to justify the nasty little notes about the "missing class secretary." (Yup, I'm still receiving them.) All kidding aside, though, the notes have been a lot easier and more interesting to write this year due to the many cards and letters that you've sent. They are much appreciated.

One such letter came this month from *Steve Samuels*, and I got such a kick out of it that I'm going to pass it on verbatim: "December *Technology Review* just arrived with your lament about the difficulties of filling the 'gaping hole between 58 and 60.' Having shared with you for four years the twice-weekly agony of trying to fill the pages of *The Tech*, I think I can sympathize with you better than most people. I'd really like to help, Glenn, but hardly anything ever happens to me. Two years ago, out of sheer desperation, I actually got married. But you only gave me one line—and by then it was, of course, too late to undo the damage.

"Now at least I've really got an item This September, after two years on leave, I returned to Purdue to a new job (i.e. tenure!) in a new office, in a brand new building, with a brand new next-door neighbor. And who was the brand new next-door neighbor? A total stranger, that's who. But total stranger or not, he's a member of the Class of '59, a former East Campus dweller, and his name is *David Root*. I see him every day, of course, and he and I and our wives play bridge together every week, and you know, I'll be damned if he isn't beginning to look familiar now. . . . See you in June, pal—maybe. I'll wear a red carnation in my lapel so you can't miss me." Steve, your writing style is going to get you into trouble: I'm going to put you right at the top of the list of nominees for this delightful office. Incidentally, I wish that I could add some news about the forthcoming Tenth Reunion, but things haven't gelled much at the time of this writing (mid-December). Because of the unfortunate time lag of the *Review*, your best bet will be to watch the mails for the bulletins which will be forthcoming shortly.

Another letter comes from *Bruce Silberg*, who has just begun computer pro-

gramming for Bankers Trust Company in New York. His last three and one-half years have been spent recovering from a very serious accident, the nature of which he doesn't explain. He visited M.I.T. recently for the dedication of the new computer building, and was quite impressed by the face which the Institute now presents. (For those of you who haven't been back recently, it'll be worth a trip back here just to see the changes that have taken place around the Boston area in general. It just ain't the same old place.) Bruce adds, "My only regret with the weekend was that without Durgin Park's roast beef, something definitely was missing."

Eugene Zuch writes that he is now associated with Intronic Inc., of Newton, Mass., as chief engineer. The company is less than three years old, and specializes in electronic function modules. Prior to that, Gene spent several years back at the Institute where he picked up a master's in EE and a second bachelor's degree, this one in industrial management. He and his wife, Linda, are now settled happily in their newly-acquired home.

My regrets to *Ahmad Kompany* whose letter last summer came all the way from Iran, only to end up under a pile of junk on my desk. Ahmad returned there in 1962, and began working for the Plan Organization, a government-owned planning body concerned with supervision and coordination of large-scale projects financed by the government.

Almost immediately, he was transferred to Khuzestan Water and Power Authority in the southwest part of the country; KWPA is assigned to construct and operate a series of dams and reservoirs on the five rivers of Khuzestan and to establish industrial and agricultural units for the best utilization of the region's natural resources and improvement of the living standard. His present position is Technical Advisor to the Managing Director; he previously was Engineer-Hydrologist, Assistant Chief, and then Chief of KWPA Resource Investigations. He was married in 1965, and he and his wife, Robie, have a two-year-old daughter and a year-old son. —*Glenn Zelders*, Secretary, Avco-Everett

Research Lab, 2385 Revere Beach Parkway, Everett, Mass. 02149

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This will be a very brief set of class notes. I'm in the middle of a bout with the flu—nothing exotic like the Hong Kong version, just plain old Cambridge winter bug; our son James has the mumps, daughter Barbara has the same flu, and Chris doesn't feel very well either. On that cheerful note, we continue.

Bob Gottlieb is Vice President of Applied Analysis, Inc. That company has just been acquired by Dynamics Research Corp., of Stoneham, Mass. (Applied Analysis' major capability is solving optimization problems using the digital computer says Bob.)

Dave Straight is "still with IBM. Have been transferred to Huntsville (Alabama) as Staff Systems Analyst doing economic analysis for space systems center. Still active in sports car racing (blew my engine at Savannah Ga., last July). Took second in C sedan in Paul Whitman Trophy Race at Daytona in August. Have new baby (Arfa—female basset hound) to go with three kids and one cat."

Dave Geisler is "working with DuPont in Martinsville making nylon. Have taken up a new hobby this past year—racing sports cars in the SCCA circuits. I have two children—Karen, 6, and David, 4, who take up most of the remaining available time. Much fun." I feel definitely out of place with my blue VW bug among all these racers.

From *Jack Schoop*: "The San Francisco Bay Conservation and Development Commission, for which I am Chief Planner, has completed its plan for San Francisco Bay and delivered it to the state legislature for action. The commission concluded there is plenty of room around the bay for all future economic development—without the constant filling that has been shrinking it in the past—if a regional agency with adequate controls is created."

Burnell West reports that he was "married to the former Ilxena I.

Acevedo in San Francisco last August 17. I am still working for EG&G—my wife teaches first grade, so our commitment to education remains strong."

Howard Braun is "currently responsible for Scientific Software—Technical Marketing for Link Information Sciences, Silver Spring, Md. My wife Elaine and I and two children (Elayne, 4, and Richard, 6) have been down here almost a year and enjoy it greatly." By the way, there are a lot of classmates in and around Silver Spring. Should make organizing enthusiasm for the 10th reunion all the easier. (hint)

There's plenty more news, but right now I'm going to have a few more aspirins; the best medical advice I've had so far has been to wash the aspirins down with a good stiff drink. That may not be much by way of medical advice, but it sure sounds like a good idea. Send your suggestions for cold remedies, helpful household hints, and general information as to your whereabouts to—**Linda G. Sprague**, 10 Acorn Street, Cambridge, Mass. 02139

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The supply of bachelors in our class continues to dwindle. **Arrigo Mongini** married Ingrid Thorson last June in Washington, D.C. That was on the same day that George married Karen Perry in Milwaukee. Jim Nick, '63, was best man and **Roy Waldheger** ushered (that's what ushers do). **Mel Cornillaud** watched. Hope he got a good view since Karen used to be a fashion model around Milwaukee. Pete Burleson was just able to file a joint return for 1967, being married two days before it ended. His wife was once called Lynne Hogarth and she once lived in S. Ste. Marie, Ontario. Pete has settled down in Arlington, Mass. and works for the Mitre Corporation. **Alvin Martin** writes: "After many years of dogging (and being dodged) I became engaged to Linda Cook of Cincinnati. The nuptials will take place February 28, 1969. After honeymoon island hopping in the Caribbean we will be in Cincinnati (save for warm weekends and holidays when we'll be at a summer place on Lake Cumberland." The groom will remain in the Industrial Chemicals Group of Proctor and Gamble.

A Navy man reports: **Lt. Millard Firebaugh**: "Have been fortunate enough to participate in building the Navy's new deep diving submarine 'Dolphin' at the Portsmouth Naval Shipyard. We are making our first trial dive to deep depth in November. Conquering inner space!" **Robert Davis** says he is, "Alive and Kicking."

Kids—young and old

Lots of kids in the class. **Jim Knoedler** has a son, Andrew, just passing his first birthday. The Knoedlers live in Houston although Jim's wife, Britta, misses the New England snow and the cooler summers. However she is ad-

justing to Texas and Texans. Jim remains with TRW systems. Linda Marlene Zeger is also about a year old now. She is the proud daughter of one **Andrew Zeger** who works at General Atronics in Wyndmoor, Pa. Also at General Atronics, but not admitting to any children, is **Pete Gray**.

Jonathan and Trudy Bulkley "have a new son, our first, Nathaniel, born in June in Washington, D.C., where I completed my military service as a captain in the Army, serving as a systems analyst with the Joint Chiefs of Staff. Now we have moved to Ann Arbor where I am on the faculty of the University of Michigan as a Assistant Prof." "Full and rewarding" is how **Don Marquis** describes life with two little girls. Amy is going on three and Melissa Wiles is approaching one. The Marquis' spend "many a week-end and the vacation days of the beautiful summer at Harwichport on the Cape. Quite a difference from last summer!"

Jack Jones announces his first child, number one son: Sean Kedric born last September 12. Jack is another member of the class working for Proctor and Gamble in Cincinnati. A week after that Deborah Anne Gabelnick was born to **Henry Gabelnick**. He works at NIH in the Biomedical Engineering Branch. **John "Tex" Ritter** writes: "This summer we added a new addition to the family, a daughter, Wendy. I am still teaching at the University of Mass. in Amherst and am thoroughly enjoying it. Just recently I had the good fortune to have a few papers published and receive a research grant. We manage to get into Boston every few months and visit with friends."

Ira Jaffe complains that I never mentioned the birth of his daughter Sheryl Renee June 2, 1967. He also wrote that **Will and Linda Kenigsberg** recently had a second son and that **Mike and Joan Wechsler** had kid number 2—a girl. He also wrote that **Harry and Ellie Bluestein** were parents to a daughter. Well, that finished up the baby patrol and on to more mundane matters.

Travelers abroad

Akram El Amin reports the scene in England where he spent his vacation. He found "that the men looked tired and the women looked sexy." Effect and cause? **Al Brennecke**: "Have now been living in Brussels, Belgium for a year. The food is terrific but, my God, it rains all the time! I guess this has been a bad summer, weather-wise, all over Europe. When mushrooms pop up overnight in the middle of your front lawn, you know its wet! We spent our two week vacation in July as far south as we could get—the Costa del Sol of Spain—and loved every sunny minute of it. My wife and I are looking forward to attending our company's first annual sale meeting in Copenhagen over New Years Eve."

Well traveled is **Paal Prestegaard**. He is with W. R. Grace and has been overseas for the last 6 years in places like Italy, Australia, Wales, Sweden and England.

Now he is back in Australia but the traveling appears to be coming to a conclusion since he expects to be assigned to N.Y.C. for good in April. I feel sorry for his wife—they must live out of a trunk. They have two children a girl, five, and a boy, two. Paal says that he saw a lot of **Tom Carman** in England last year. The Carmans live in Surrey and recently had a third boy. Also assigned abroad is Captain **Roger Whitman**. He is the Assistant Brigade Supply officer for the 3rd Brigade of the 82nd Airborne Division in Vietnam. Major **Pete Bankson** is back from Vietnam and now teaches ROTC at Dartmouth.

Academics

Presumably due to the grand Profs we all knew and loved at the Institute quite a few members of the class are going into teaching. To wit: **Lloyd Fisher** is Assistant Professor in math, University of Washington. **Don Fowles** is Assistant Professor of psychology, University of Oklahoma and is teaching psychological psychology (whats that!), psychophysiology and experimental psychopathology. After getting his Ph.D. from Purdue, **Max Keck** is now teaching physics (another assistant professor) at John Carroll U., in Cleveland. The job is one-half teaching, one-half research. While at Purdue he met and married Roberta Pantle who was there getting an M.A. in French. Last fall **Sue Lippman Kannenberg** got a Ph.D. in experimental physics at Northeastern. Her husband (also of '61) **Lloyd Kannenberg** received his Ph.D. from Northeastern, in field theory and general relativity. They live in Waltham. Lloyd is a physics instructor at Lowell Tech. **Seymour Cromwell** teaches physics, chemistry and math at the Collegiate School in N.Y.C. (isn't that where John Kennedy, Jr., is going this fall?). After five years of "sporadic attendance" he completed a masters degree in ME at Stevens Tech. **Edmond Berger**: "Am spending the present (1968-1969) academic year at the University of California in Berkeley on leave from my position as Assistant Professor of physics at Dartmouth College. I am engaged in research in the theory of particles." **Walter Loveland** continues the parade of Assistant Professors. He is at Oregon State University in the chemistry department and is working on studies of nuclear reactions (primarily fission) and cosmochemistry. **Pete Hurwitz** is Assistant Professor of chemistry at the University of Massachusetts in Boston. His qualifications include a 1966 Ph.D. from Brandeis.

Tom Lawford is still in school. He writes: "I am just finishing up my last year in medical school (U. of Va.). I haven't decided on where to intern. I'm interested in both industrial aerospace medicine and clinical medicine (neurology). Just don't know which it will be yet. Still driving my same old ancient '57 T-Bird and patch it together with epoxy resin. My Ham radio activity is zero." A sad, but unfortunately common tale is told by **Clarke Swannack**. "I expected a Ph.D. at Carnegie Tech in Experimental Nuclear

Physics in 1968—but now maybe 1969 unless the Army steps in. I'm now 1A. The AEC is cutting funds on my research and I've gone through 3 advisors in less than a year and lost most of the supporting personnel. I am doing an ultra fine experiment on $\pi^+ + \text{Li}^6 \rightarrow \text{He}^4 + 2p$ using on-line computer spark chamber techniques; looking at core excitations and internal pair correlations."

Edward Whitman has nearly completed his Ph.D. in EE the University of Maryland—only the writing of a thesis is in the way. It will be on the spectral analysis of sampled data. He is still working at the Naval Ordnance Lab in Silver Spring. That was where he did his 6-A Co-op work and he just stayed on. **Herb Schaake** is also mixing work with study toward a Ph.D. He is at the University of Florida where he received a masters in metallurgy and materials engineering last August. That seems to have gotten him a promotion to Head, Ceramics Research and Development, Orlando Division, Martin-Marietta Corp. Just think what a Ph.D. will get you, Herb!

Leonard Coris is going the same route. He is a full time student at M.I.T.'s Sloan School while running his own personal financial planning firm in Boston. **Andre Willner** got his Ph.D. from M.I.T. last January (1968) in material science, specializing in the mechanical behavior of polymers. Now he's a research scientist with American Cyanamid in Stamford, Conn. He lives in Stamford with wife, Linda, and son, Philip (2). **Paul Robertson** writes: "I received an M.S. (EE) from Drexel Institute of Technology in Philadelphia, June 15, 1968. Since last October I've been at Radiation Incorporated as a lead engineer, Data Systems Engineering Department. The firm is located in Melbourne, Fla. Have returned to the sport of my college days finished 7th in a half marathon last February."

Don Traffin finished the associateship exams of the Society of Actuaries recently. This ought to help in his job at State Mutual Life. He says that he ran into **Ed Sonn** last fall at the reunion of their respective wives, both ladies being from the Class of '63 at Emmanuel College. Ed is working for IRA Systems, Inc., in Waltham, Mass. and is manager of computer applications. Over at Connecticut General Life Insurance Co. **Raymond Johnson** is an EDP systems analyst responsible for actuarial systems and the development of new systems for the individual insurance department. His wife, Elane, is a part time Medical Records Librarian at Hartford Hospital and is President of the Hartford Simmons Club. They have two boys, Greg, six, and Jeff, three.

Switching jobs

Of course, some people are switching jobs. **Fred Schmidt** left the CIA and now works for Horizons, Inc., in Cleveland, Ohio. He is a project supervisor researching unconventional photo materials. He and wife, Eileen, had their first child,

Frederick Clarence last June. **Bill Watson** stays at IBM but moves from Yorktown Heights, N.Y., down to their Manufacturing Branch Office in Newark, N.J. He leaves behind **Henri Schnurmman** who is still on the IBM research staff. Henri is working on the development of ultra-reliable computers. He married Miriam Rhein in 1964 and since graduation has picked up an M.S. EE from B.P.I.

Robert Mroczkowski started a new job last October at Laser Diode Labs. in Metuchen, N.J. He'll be doing research and development work on mixed III-V compounds for light emitting diodes. Starting last September **William Jouris** began working for M.I.T.'s Instrumentation Lab. He is managing the efforts of the lab in the field of radiation testing of Lab designed missile guidance systems and components.

Bob Pease is staying put at Philbrick/Nexus and is a senior staff engineer of development and application of linear IC's and analog modules. "All sorts of work and fun," he says. He also mentions that he is still getting in some mountain climbing. **Joe Davis** is working for Delta Air Lines in Atlanta as Performance and Analysis Engineering Superintendent. He was married to Carol Surface in 1963 and they have two small girls.—**Andrew Braun**, Secretary, 131 Freeman Street, Brookline, Mass. 02146

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Gordon Garmire and two other associates of M.I.T., discussed their work on an OSO-III experiment at the dedication of the M.I.T. Center for Space Research on April 25, 1968 and noted that their experiment was the first definite observation of a nonuniform gamma-ray brightness in the sky. An OSO (Orbiting Solar Observatory)-III experiment has seen cosmic rays with energies above 70 MeV coming from our galaxy. The gamma rays show a bright glow around the galactic equator with the brightest spot near the direction of the galactic center in the constellation of Sagittarius. We look forward to more news in this area, Gordon.

Charles Sve, wife and son "Chuckie" have recently moved to El Segundo, Calif. where he has accepted a position with Aerospace Corporation. He recently completed the requirement for the degree of Doctor of Philosophy at the Technological Inst., Northwestern Univ., Evanston, Ill.

Leonard E. Smollen of EG&G's Custom Equipment Division was recently promoted to principal scientific executive. In his present position, Smollen is a program manager for the Custom Equipment Division. Congratulations, Leonard! **A. E. Paladino, Jr.**, who completed work for his Sc.D. in ceramics under a Raytheon grant, is principal scientist, Research Division, Raytheon Company. Dr. Paladino, the incoming chairman of the Basic Science Division,

has served the Division as secretary, vice chairman and chairman-elect.

A patent for a lens which will permit Ion Physics Corporation to produce transistors and other semiconductor devices by "writing" them with an ion beam has been awarded to **Stanley Harrison**, who is a group leader in the firm's Solid State Division. Harrison has designed an improved electrostatic quadrupole lens which focuses down the beam to an extremely fine resolution and makes possible the exact controls required for semiconductor production.

John M. Cozzolino, Jr., writes that he is currently an assistant professor of statistics and operations research at the University of Pennsylvania, and he and his wife, Carol, now have two children and reside in New Jersey. **John C. Hermanson** writes that he and his wife have twin girls, (19 months) and that he received a research fellowship from Miller Institute for Basic Research in Science, University of California Department of Physics, Berkeley, for 1968. Hermanson has been with the Department of Physics & Materials Research Laboratory, Univ. of Ill.

George M. Haney recently married **Nessie Duerr** of Los Angeles and is presently working on his Ph.D. thesis in E.E. at USC plus working part-time at Hughes Aircraft Co. **Michael R. Terry**, who served aboard U.S. Lynde McCormick in the Pacific 1962-1964, then in 1964-1966 was project officer for U.S.S. Plainview (AGEH-1), Ocean Hydrofoil at Seattle, married a Seattle girl in 1966 and is now at M.I.T. in course XIII for a Naval Engineering Degree, which he will complete in 1969.

The Boston Company, Inc., announced in October the election of **Richard A. Crowell** as Vice President. Crowell graduated from M.I.T. in '62, received an M.S., '64, and a Ph.D., '67. Officers and committee chairmen for the 1969 Spring Joint Computer Conference, to be held at Boston's War Memorial Auditorium next May 14-16, have been announced and among them is **Albin A. Hastbacka** of the Aerospace Systems Division of Radio Corporation of America, Burlington, Mass., as Secretary. This group constitutes the steering committee for the thirty-fourth semi-annual joint computer conference, which brings together more than 5,000 computer professionals to discuss current problems, developments and trends in the computer industry.

Harold E. Benzinger writes that he received his Ph.D. in math from Syracuse University in June, 1967, and accepted a position as assistant professor of math at the University of Illinois in Urbana, however he is currently functioning as a Captain at Ft. Meade, Md., and will return to Illinois in Oct., 1969. **Lane Anderson** reports that his wife **Jacqueline** is a violinist with the Washington National Symphony, while he is a violoncellist also with the Symphony, and that he has frequent recitals and chamber

music performances in the Washington area, most notably at the Smithsonian Institution.

Henry N. McCarl, who coauthored a recent article on the cement industry in the *Technology Review* (December 1967), is now a participant in a committee for Economic Development Seminar on Education, which recently held a meeting in New Orleans. **George Krebs** is now finishing up a Ph.D. in physics at Rutgers Univ., and has accepted a position as instructor at Marietta College to begin this month. **David E. Nickles** brings up to date and reports that he spent 2 years active duty in the Navy after graduation (1962-1964) on U.S.S. Joseph P. Kennedy, Jr., as Division Officer in English Department. He then completed graduate work at M.I.T. for an M.S. Course in X. He is now working for DuPont's Development Department in Wilmington, Del., on building products venture and process development work on acrylic marble (Corian)®. He has also just completed his M.B.A. at the University of Delaware extension program in marketing.—**Gerald L. Katell**, Secretary, 310 Hoge Building, Seattle, Wash. 98104

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I'm sure you have received by now the first letter concerning our forthcoming reunion. The committee is headed by **Bob Scott**, and the address of the Reunion Committee is: P.O. Box 109, M.I.T. Branch Post Office, Cambridge. The target date is roughly June 13-15, and all inquiries or suggestions will be welcome.

Meanwhile . . . **Richard Adamec** completed three years in the Army in November, 1967, and is now developing methods analysis procedures for Isbrandtsen Steamship Lines. **Ralph Bestock** is at Fairchild Semiconductor working on computer designs of large scale integrated circuits. His wife Donna is at Stanford working on a Ph.D. in philosophy. **Robert Chinchillo** recently presented a technical paper in Washington, D.C., on integrated microwave circuits. He is a microwave design engineer at Raytheon's Bedford laboratories. **John Drumheller** has started an on-line computer service bureau, Ikon, Inc., in Seattle. His son is now a bit over a year old. **John Eulenberg** is working on his Ph.D. in linguistics at the University of California in San Diego. He is specializing in the Hausa language of Nigeria, of which all classmates traveling to that area should make note. On a more mundane level, he is also an account executive for two brokerage houses, one in Boston and one in California.

John Goddard was married this past June to Carolyn Kuhr of Walnut, Iowa, who worked for the Federal Reserve Bank in Chicago. He is now in the R&D department of Union Carbide in Niagara Falls, N.Y. **Eric Greenwell** works for Battelle Labs in Washington state, and as a hobby races his TR-4 and is building a VW

dune buggy. He has become the auto champion of the local desert. **Herb Herrmann** is working for the Navy as a project manager directed toward establishing structures on the deep ocean floor. He also teaches at the University of Southern California and goes scuba diving. **Robert Hershey** recently joined Bolt Beranek & Newman, Inc., as a senior scientist. He is engaged in research in anti-submarine warfare under Navy contracts. **Paul Holland** started last June as an employee of Richardson and Holland Corp., food manufacturer.

Joe Hollweg was married last June, and is now doing post-doctoral work at the Max Planck Institute in Munich. **John Huguenin** has completed four years in the Air Force, and is now back at M.I.T. pursuing graduate work in ocean engineering. **Robert Kimmel** has finished his Sc.D. in materials engineering at M.I.T., and is now a research chemist at Celanese Research Co., Summit, N.J. His wife Dee Anne received her M.S. in library science at Simmons and is now head of a children's library in South Orange. **Arjeh Kurtzig** recently received his Ph.D. in physics at Stanford. His doctoral thesis was published in the September 1968 issue of *IEEE Transactions on Magnetism*. **Paul Lubin** and his wife Myrna are the proud parents of a daughter, Suzanne Judith, born on August 8, 1968. **John Reed** is finishing up on his Ph.D. at Columbia—between riots. In September he will become an assistant professor of sociology at the University of North Carolina.

Robert Sanders is working for Sylvania in Waltham, Mass. He and his wife Sara became the parents of Toby Lynn on November 9, 1968. **Riley Sinder** has come up with a recipe for Harvard Yard Squares, better known as brownies. Culinary artists in the class can write him for the recipe. **Robert St. Aubin** is practicing law in Philadelphia, and has recently bought a home. **Robert Warakomsky** is attached to the London office of the U.S. Coast Guard, where he has wide-ranging engineering responsibilities. Let me hear from you.—**Ron Gilman**, Secretary, 1021 Oakmont Place, Apartment 8, Memphis, Tenn.

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Dan Murphy married the former Miss Sally Werner (M.I.T. '68) in September 1967 and is working for Bolt, Beranek and Newman in Cambridge. He also spends some time as a disc jockey and chief engineer for WNTN radio in Newton.

Bruce Appleby reports wife, Nancy, and son, Stephen Michael, are doing well while Steve does graduate work in math at M.I.T. **Dave Waltz** is at Tech doing his doctoral research with the artificial intelligence group. **Pat Dawe** has finished his graduate work at the University of Pennsylvania and is now working for the Philadelphia City Planning Commission in the Model Cities program.

Martin Thomas is now a Marketing Research Analyst for Scott Paper Company in Philadelphia after receiving his M.B.A. at the University of Chicago's Graduate School of Business. **Cash Peacock** is a 1st Lieutenant in the army transportation corps and is now doing operations analysis for the united services transportation headquarters. Cash is now living in New York City and reports he's still single with no commitments. **Sam Drake** is working on his master's while working at the M.I.T. Instrumentation Lab on the Apollo Project.

Jeff Meldman has joined the teaching staff at M.I.T. Jeff was the president of the Harvard Law School's computer committee and recently delivered a paper at the American Bar Association's annual meeting in Philadelphia. **Efraim Arazi** is heading up a new venture for Itek Corporation which is to be located on the compound of the Weizmann Institute of Science in Rehovoth, Israel. **Jim Young** was on the Stanford research team which developed a laser that can generate visible light at tunable, varying wavelengths.

George Lee received his master's in communications sciences from the University of Michigan in April 1967, and has been working for TRW in Redondo Beach, Calif., since then in the application of computer-aided design of printed circuitry. **Tom Maugh** married the former Miss Kathy McAllister in July 1967, and is now doing graduate work on a National Health Institute Fellowship. **Steve Donahue** finished his army active duty as a captain and is now at Proctor and Gamble in Cincinnati working as a distribution analyst. Steve married the former Miss Lourdes Ribera of Lima, Peru in June, 1966.

Doug Patz is thoroughly enjoying the Western climate while at the University of Arizona doing experimental work in measuring the gravitational deflection of light waves. **Paul Eich** finished his master's work at the Sloan School as well as completing his master's in chemical engineering and he will soon be a Lieutenant in the Navy. **Scott Hynek** reports his marriage to the former Susan Booth and that he is working on his Ph.D. in mechanical engineering at M.I.T. **Bill Grosky** received his master's in applied math from Brown and is now in the doctorate program in computer sciences at Yale.

Larry Stark has finished his Master's and is continuing on for his Ph.D. in solid state physics at Cornell. . . . **Doug Spreng** is the product line manager for signal generators for Hewlett-Packard in Palo Alto. . . . **Jerry Robertson** has started a 13-month tour of duty in South Vietnam while his family remains in Boston. . . . **Tom Van Vleck** is continuing his work at Project MAC. **Bary Pollack** has been appointed an instructor at the U. of Cal. at Berkeley and will be teaching for the computer science dept.

John Hood is now a junior at the Columbia Presbyterian Medical School and will spend this winter studying tropical medicine at the Firestone Plantation in Liberia, Africa. *Anthony Layton* is now a 1st Lieutenant at the Army's Aberdeen Proving Grounds. *Don Kutyna* is working in the experimental test pilot division of the Aerospace Research Pilot School at Edwards AFB, Calif. *Shyamadas Banerji* married the former Miss Sarah Lee Johnson and is now working at the Franklin Institute Research Laboratories in Philadelphia. *Tom Perrone* is now a weather officer at Stewart AFB, N.Y. Tom earned a second B.S. in meteorology at Penn State and married the former Miss Nancy Jean Eaton of West Hickory, Penn. *Jack Hudgens* finished his master's work at the University of Southern Cal.

George Kossuth married the former Miss Beth Healey last summer and is working at the M.I.T. Instrumentation Labs. *Richard Schwarz* is presently doing doctorate work in chemistry at Duke University. *George Meacham* joint-authored a paper for the Department of Commerce. *George Steele* is working for McDonnell-Douglas in Huntington Beach, Calif., doing design work in life support systems.—*Jim Wolf*, Secretary, 24455 Lake Shore Boulevard, Apt. 1114, Euclid, Ohio 44123

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This month the honor of writing the class notes returns to the male section of the class secretariat. In general we shall try to give the female view on alternate months, but it really depends on who has more tests at the time copy is due. In case you've been wondering where I get the information for this column, there are many sources. I receive monthly from the *Review* and the Alumni Association notices of address changes, clippings about class members (often from their wife's alumnae magazines), and notes sent along with Alumni Fund donations. These usually contain vast amounts of random information which we attempt to correlate. Other valuable sources of information are classmates I see around the Institute and those who simply write me occasionally about what they and their friends are doing. I am most grateful to those in this last category and would be glad to print any news I receive. So keep those cards and letters coming folks!

John Cooper was married to Helen Cogbill in June in Cambridge. She attended Pembroke and graduated from B.U. They're living at Eastgate while he's in grad school. Also living at Eastgate are Pam and Scott Marks. Pam is working as a secretary in the Information Processing Center while Scott is back in Course VI. I recently

bumped into a classmate who is now working for a large aerospace company at Cape Kennedy. He asked that I not report his name, but said that he was extremely disillusioned by the space program and hopes to return to school in September if his draft board is willing. It seems he was hired as a "test engineer" but has only been assigned work in technical editing. I hope nobody else has been caught in similar situations.

Dick Turner writes that he is now at the University of Michigan courtesy of the Air Force, and will receive an M.S. in April. He was happy to find that the University of Michigan has no thesis requirement. Dick reports that *Dan Gruber* is now in the Army and is stationed at Aberdeen Proving Grounds, Md., as a calibration specialist. *Don Rogut* is now working for Pratt and Whitney in Hartford, Conn.

We've heard that the following classmates have brothers who are in the Class of '72: *Dennis Baron*, *Peter Lum*, and *Robert Weiss*. Nothing like keeping it in the family. *Linda Stutte* is in graduate school in physics at Berkeley and finds that it's very different from M.I.T. *Sven Stork* is Laboratory Director of Atlas Copco Airpower N.V., Wilrijk, Belgium. That's about all for this month, just keep the news coming in.—*Gail* and *Mike Marcus*, Eastgate—Apartment 4H, 60 Wadsworth Street, Cambridge, Mass. 02139

Course Review

Copy for this issue of *Technology Review* was due from your Secretary about December 10. Information reaching him after that date will be reported in the March issue.

VI

Sandor Holly, S.M.'60, is Technical Director in charge of the Research and Development Section of General Laser Corporation in Natick, Mass. During his graduate program at M.I.T. he worked as Research Assistant with Professor Louis D. Smullin in microwave instrumentation and microwave tube development. Employed at IBM Research Center at Yorktown Heights, N.Y., from December 1959 to September 1961 he became involved in IBM's pioneering laser activities and his contributions led to an invention relating to a high-Q optical resonator. Entering upon a doctoral program at Harvard University he was employed at Arthur D. Little Company in

Cambridge, sometimes part-time, sometimes full-time, until 1968 when he received the Ph.D. degree. At Arthur D. Little, he was responsible for the design of microwave equipment in studies of superconductive tunneling assemblies and microwave interactions. His present research activities at General Laser Corporation include searching out new methods and techniques for generating and controlling coherent optical radiation with applications. He also deals with specialized industrial problems using electro optical means. Dr. Holly's undergraduate work was done at the University of Sciences, Budapest, Hungary.

Barrett C. Griffith, S.M.'26, Sc.D.'28, celebrated in October 1968 his 40th anniversary of service with the Bell

System. He is currently engaged in transmission studies at Bell Telephone Laboratories in Holmdel, N.J. He began his Bell System career with the American Telephone and Telegraph Company's Development and Research Department which became a part of Bell Laboratories in 1934. He was concerned with inductive interference studies until 1936 when he turned to carrier systems development. Subsequently he worked on telephone noise and crosstalk problems. He has been a member of the Transmission Objectives Department since 1950. His undergraduate work was done at the University of Toronto. (See photo next page)

Captain *Harold T. Hendrickson*, S.M.'56, is a Research Specialist with the Missile



Barrett C. Griffith, S.M.'26, Sc.D.'28, Course VI, of the Bell System, and Rear Admiral Robert L. Townsend, '43, Course XVI (left to right).

and Information Systems Division of the Boeing Company, Seattle, Wash. He received the B.S. degree in 1942 from the Coast Guard Academy, New London, Conn. As Lieutenant Commander and Chief of the Technical Services Section, Electronics Engineering Division at U.S. Coast Guard Headquarters in 1954, he was selected for a special two-year graduate course in electronic engineering at M.I.T.

HsuYun Fan, S.M.'34, Sc.D.'37, is Duncan Professor of Physics at Purdue University. His M.I.T. friends recall his return to China in 1937 as Professor of Electrical Engineering at Tsing Hua University as the Peiping campus was being occupied and the educational program disrupted by the invading Japanese troops. We should like to hear his story of the intervening years.

Benjamin J. Leon, S.M.'57, Sc.D.'59, is Visiting Professor at Cornell University this academic year on sabbatical leave from Purdue University. He is Editor, *IEEE Transactions on Circuit Theory*, and is on the Board of Directors and the Board of Trustees of the National Electronics Conference. He is Consulting Editor for Holt, Rinehart and Winston, Inc.

George L. Slenkovich, S.M.'63, is with Applied Technology, Inc., Palo Alto, Calif. From 1963 to 1966 he was a research engineer in the Electronic Defense Laboratories, Sylvania Electronic Systems, Mountain View, Calif., where he studied the application of statistical communication theory to electronic warfare problems. In his master's thesis, under the supervision of Mr. Godfrey T. Coate of the Electronic Systems Laboratory, he developed a technique for the fabrication of point-contact tunnel diodes for use in microwave receiver circuits. His undergraduate work was done at the University of Pittsburgh. —*Karl L. Wildes*, Correspondent, Room 4-232, M.I.T., Cambridge, Mass. 02139

XVI

The Lives and Times of the Graduate Alumni of Course XVI: Chapter 4.

Let's begin this chapter by bringing you up to date on the fortunes of a man who will be remembered by many. *Ares G. Bogosian* came to us after his graduation from the University of Rhode Island. He was instructor and research assistant in the Flutter Laboratory while earning his masters. That was in 1941. After time out for naval service with BuAer and Fleet Air Wing II, Lieutenant Commander Bogosian returned in 1946, and for the next seven years was a project engineer at the Instrumentation Laboratory, and made important contributions to several guidance systems under development at the time. In 1953 he left us to go into industry. At Lockheed, Rand, American Radiator and Epsco he had a variety of assignments, then in 1962 joined Standard Kollsman where he is now Assistant to the President.

Ares' major responsibilities are in the areas of development planning, improvement of company organization, and personnel. One interesting aspect of the last mentioned is his application of computer techniques to the far-flung organization's human resources. The Bogosians have two children, Gale, 17, and Armen, 20, and live in Huntington Bay (that is, the town of that name), out on Long Island. Maybe that's one reason why *Ares* recommended that the corporate offices be moved out to their suburban Syosset plant. Syosset is just a step and a jump from Huntington. (Note: the move was made.)

Colonel *Charles L. Wilson*, '63, USAF, spent a couple of years at SAC headquarters after leaving us, then went back to school at the Army War College, Carlisle Barracks in Pennsylvania. From there Chuck went to the Pentagon in HQ USAF as Chief, Strategic and Defensive Branch, Directorate of Command Control and Communications. That Directorate had a good start for forming its own M.I.T. Club. Its Chief was Major General *Gordon T. Gould, Jr.*, a Course VI S.M. in 1950, and another member was Lieutenant Colonel *Joseph T. McKinney*, who got his masters with us in 1954.

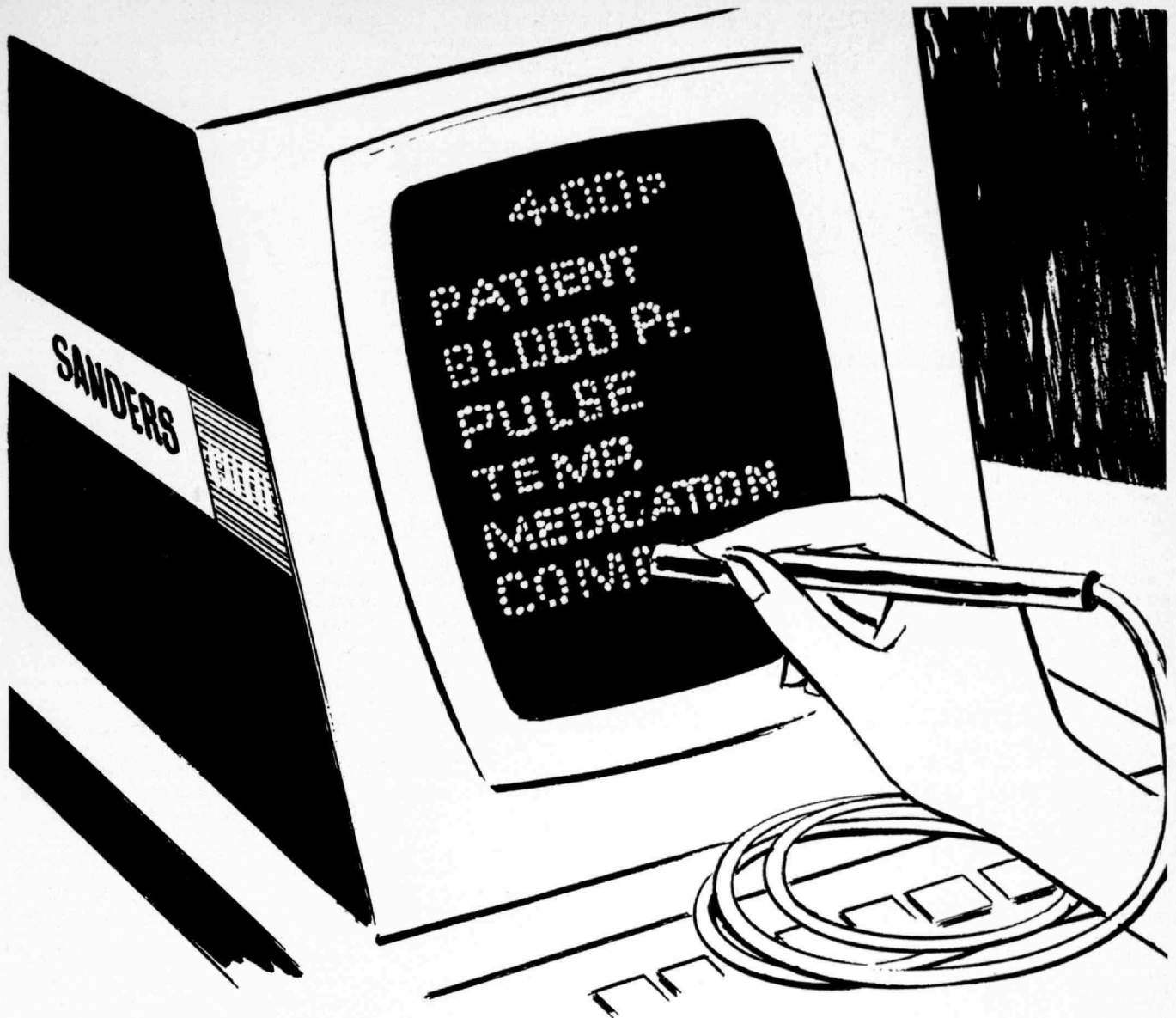
A couple of months ago we gave you a rundown on the career of one of our high-ranking Navy graduates, now we

follow up with another. Rear Admiral *Robert L. Townsend*, '43, graduated from the Naval Academy in 1934. After two years afloat he was ordered to Pensacola, and in 1937 was designated a Naval Aviator. Then followed three years on the USS *Lexington* with Bombing Squadron 2. In 1940 he returned to Annapolis to study Aeronautical Engineering, the continuation of which led him to M.I.T. Following a bit of shipyard duty, he then joined the newly commissioned USS *Tripoli* as Exec. The *Tripoli* operated in the Atlantic first, as a member of a hunter-killer group, then joined the First Fleet in the Pacific, where she did everything from transporting planes and Japanese prisoners, to "Magic Carpet" duty returning troops home to the U.S.

Quickies

From Commander *Wilbur C. Klemm*, '57, USN: "I am an Engineering Duty Officer specializing in Ordnance, currently assigned to the Fire Control and Guidance Branch of the Special Projects Office. My particular duties at the moment pertain to the task of establishing and supervising the fire control computer programming for the *Polaris* and *Poseidon* programs." Captain *John C. Giffen*, '66, USAF: "Address, SHAPE (OAIREDP) APO etc.; Present Job, Aide-de-Camp to Air Deputy, SHAPE." Don A. Coulter, '65: "At present I am working as a proposal manager for research contracts for the Missile and Information Systems Division of the Boeing Company, Seattle, Wash."

So much for this time. At the risk of being repetitious, may I remind you that much of this information came some time ago. The response to my questionnaire would have filled a whole issue of the *Review*. It was great, but it has to be doled out in reasonable quantities. As a consequence there will have been changes all along the line, so do bring me up to date. All the best from Cambridge.—Professor *Walter Wrigley*, Correspondent, IL3-419, M.I.T., Cambridge, Mass. 02139



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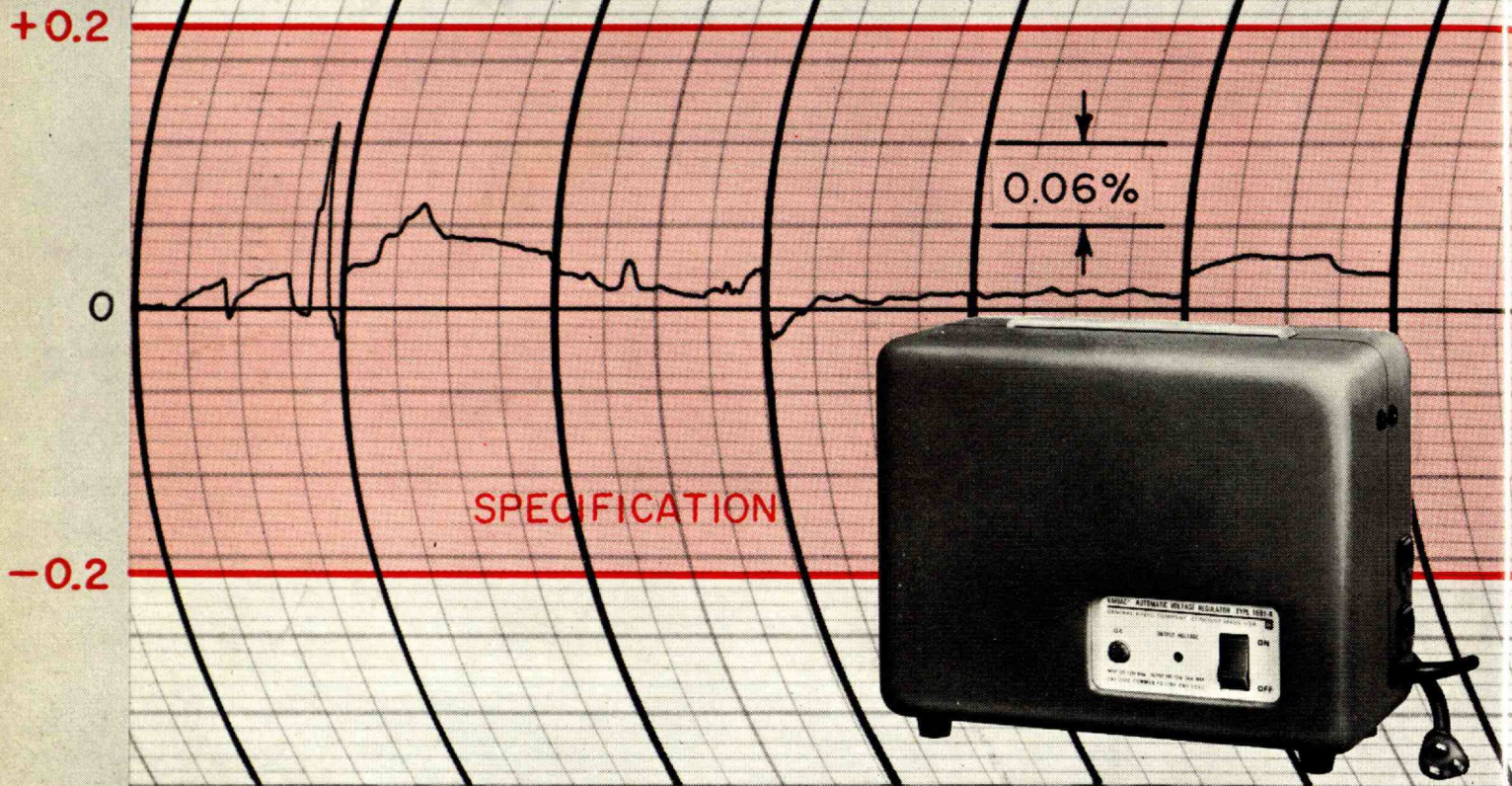
WRITE to Mr. James L. Hackbush, Sanders Associates, Inc., Dept. 467TR, 95 Canal St., Nashua, N.H. 03060.

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